



**WESTERN  
PACIFIC  
REGIONAL  
FISHERY  
MANAGEMENT  
COUNCIL**

# **Measures to Reduce the Incidental Catch of Seabirds in the Hawaii Longline Fishery**

**A Framework Adjustment to the  
Western Pacific Pelagic Fisheries Management Plan**

**Including an Environmental Assessment and  
Regulatory Impact Review/Regulatory Flexibility Analysis**

**December 13, 1999**

**Western Pacific Regional Fishery Management Council  
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## 2.0 Summary

The fleet of fishing vessels holding 164 Hawaii longline limited access permits and operating with longline gear inadvertently hook and kill black-footed albatrosses (*Phoebastria nigripes*) and Laysan albatrosses (*Phoebastria immutabilis*) that nest in the Northwestern Hawaiian Islands (NWHI). To mitigate the harmful effects of fishing by Hawaii-based longline vessels on seabirds the Council recommends that vessels registered for use under a Hawaii longline limited access permit operating with longline gear above 25° N. latitude be required to adhere to two or more of the following measures: 1) maintain adequate quantities of blue dye on board and use only completely thawed, blue-dyed bait; 2) discard offal while setting and hauling the line in a manner that distracts seabirds from hooks; 3) tow a NMFS-approved deterrent (such as a tori line or a buoy) while setting and hauling the line; 4) deploy line with line-setting machine so that the line is set faster than the vessel's speed and attach weights equal to or greater than 45 grams to branch lines within one meter of each hook; 5) attach weights equal to or greater than 45 grams to branch lines within one meter of each hook; 6) begin setting at least one hour after sunset and complete setting at least one hour before sunrise, using only the minimum vessel's lights necessary for safety. In addition, the Council recommends that 1) vessel operators be required to make every reasonable effort to ensure that birds brought onboard alive are released in a manner that ensures their long-term survival and 2) all vessel captains annually complete a protected species educational workshop conducted by the National Marine Fisheries Service.

## 3.0 Table of Contents

1.0	Cover Sheet .....	1
2.0	Summary .....	2
3.0	Table of Contents .....	2
4.0	Introduction .....	3
4.1	Responsible agencies .....	3
4.2	Public review process and schedule .....	3
4.3	List of preparers .....	4
5.0	Purpose and Need for Action .....	4
6.0	Management Objectives .....	7
7.0	Initial Actions .....	8
8.0	Management Alternatives .....	10
9.0	Consistency with National Standards for Fishery Conservation and Management .....	13
10.0	Relationship to Other Applicable Laws and Provisions of the Magnuson-Stevens Act ..	14
10.1	National Environmental Policy Act .....	14
10.2	Executive Order 12866 .....	38
10.3	Regulatory Flexibility Act .....	38
10.4	Coastal Zone Management Act .....	39
10.5	Endangered Species Act .....	39
10.6	Marine Mammal Protection Act .....	42
10.7	Paperwork Reduction Act .....	43
10.8	Other Applicable Laws .....	43

10.9	Traditional Indigenous Fishing Practices .....	44
11.0	Appendix I: Proposed Specifications for Selected Mitigation Measures .....	45
12.0	Appendix II: Regulatory Impact Review/Regulatory Flexibility Analysis .....	47
13.0	Appendix III: Future seabird mitigation research and monitoring seabirds at sea .....	58
14.0	Appendix IV: Background Information .....	63
15.0	Appendix V: Proposed Regulations .....	83
16.0	References .....	85

## 4.0 Introduction

### 4.1 Responsible agencies

The Western Pacific Regional Fishery Management Council (Council or WPRFMC) was established by the Magnuson Fishery Conservation and Management Act of 1976 (Public Law 94-265; 16 U.C.S. 1801 *et. seq.*) to develop fishery management plans (FMPs) for fisheries operating in the US Exclusive Economic Zone (EEZ) around American Samoa, Guam, Hawaii, the Northern Mariana Islands and the remote US Pacific Island possessions.<sup>1</sup> Once an FMP is approved by the Secretary of Commerce (Secretary), it is implemented by Federal regulations which are enforced by the National Marine Fisheries Service (NMFS) and the US Coast Guard, in cooperation with state agencies.

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### 4.2 Public review process and schedule

Prior to the 16-18 June 1999, Council meeting an information document was circulated to all interested parties, including all holders of NMFS Hawaii longline limited access permits. This document outlined the nature of the problem and the alternative solutions which the Council may consider. Workshops were conducted by staff of the Council and NMFS Pacific Islands Area Office on 21 and 28 May 1999, to explain the problem to fishermen and discuss with them possible mitigation measures. At their June meeting, the Council considered recommendations made by these fishermen, the Pelagics Standing Committee and other advisory groups such as the Pelagics Fisheries Plan Team and Scientific and Statistical Committee. The Council agreed to

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<sup>1</sup> Howland Island, Baker Island, Jarvis Island, Johnston Atoll, Midway Island, Kingman Reef, Palmyra Atoll, and Wake Island.

proceed with further action under the framework process, and the issue was placed on the agenda for the 18-22 October 1999, Council meeting. A document describing the issue, alternative ways to resolve the issue, the preferred action and the anticipated impacts of the management alternatives was prepared and distributed to the public with a request for comments. A notice was published in the Federal Register (64 FR; September 30, 1999) summarizing the Council's deliberations and preferred action and indicating the time and place for the Council meeting to take final action. The Council took final action at the Council meeting on 18-20 October 1999.

#### **4.3 List of preparers**

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#### **5.0 Purpose and Need for Action**

The fleet of fishing vessels holding 164 Hawaii longline limited access permits and operating with longline gear inadvertently hook and kill black-footed albatrosses (*Phoebastria nigripes*) and Laysan albatrosses (*Phoebastria immutabilis*) that nest in the Northwestern Hawaiian Islands (NWHI). These seabirds follow the longline vessels and dive on the baited longline hooks as the vessels deploy their fishing lines. Incidental catches of seabirds may also occur as the longline is hauled. However, birds are more often killed during longline setting because as they become hooked or entangled, they sink with the fishing gear and are drowned, whereas if birds are hooked during the haulback they can be released. Besides the direct mortality to juvenile or adult birds, fishing-related deaths may also have a negative influence on chick survival if one or both parent birds are killed.

The NMFS, Southwest Fisheries Science Center, Honolulu Laboratory (NMFS, SWFSC Honolulu Laboratory) used data from NMFS observer reports and the NMFS Western Pacific

Daily Longline Fishing Log to estimate the annual incidental catch of seabirds in the Hawaii longline fishery between 1991 and 1998, and the spatial distribution of the catch. Fleet-wide incidental catch estimates were computed using a regression tree technique and bootstrap procedure (Skillman and Kleiber 1998). The regression tree technique reveals structure in observer data sets and can be applied to an array of independent variables (e.g., month, latitude, longitude, target species, gear type, sea surface temperature and distance to seabird nesting colonies). The model is "pruned" by cross-validation, meaning that only the statistically significant predictors of seabird catches are kept in the analysis. Catches of black-footed albatrosses were found to be significantly related only to proximity to nesting colonies and longitude, while catches of Laysan albatrosses were significantly related only to proximity to nesting colonies and year (Cousins and Cooper in prep.). The statistical model was then applied to daily logbook records reported by longline vessel captains to generate estimates of fleet-wide seabird catch estimates. The uncertainty in the estimates, expressed as 95% confidence bounds, was assessed with a non-parametric bootstrap technique (Efron 1982; Efron and Tibshirani 1993). It is estimated that between 1994 and 1998, an average of 1,392 Laysan albatrosses and 1,831 black-footed albatrosses were killed in the Hawaii longline fishery each year (Table 5.1). These average annual incidental catches represent about 0.6% and 0.06% of the estimated worldwide black-footed and Laysan albatross populations, respectively. At present it is estimated size of the breeding and non-breeding populations of black-footed and Laysan albatrosses are about 300,000 and 2.4 million birds, respectively.

Table 5.1. Estimated annual total incidental catch of albatrosses in the Hawaii longline fishery based on catches recorded by NMFS observers on monitored fishing trips. Values in parentheses are 95% confidence bounds.

Year	Black-footed Albatross			Laysan Albatross		
	Observed Catch	Estimated Total Catch		Observed Catch	Estimated Total Catch	
1994	126	1,994	(1,508-2,578)	73	1,828	(933-2,984)
1995	105	1,979	(1,439-2,497)	107	1,457	(767-2,308)
1996	59	1,568	(1,158-1,976)	31	1,047	(569-1,610)
1997	107	1,653	(1,243-2,101)	66	1,150	(599-1,875)
1998	46	1,963	(1,479-2,470)	56	1,479	(822-2,336)

Source: NMFS, SWFSC Honolulu Laboratory.

Black-footed albatrosses are less abundant than Laysan albatrosses at the NWHI, with about 59,622 nesting pairs, versus 558,378 nesting pairs of Laysan albatrosses (Cousins and Cooper in prep.). Neither albatross species is listed as endangered, but both are protected under the US Migratory Bird Treaty Act (16 U.S.C. 703 et. seq.). The long term chronic mortality resulting from the fishery may have a deleterious effect on these bird populations, particularly

the less abundant black-footed albatross (Cousins and Cooper in prep.). Although, one or two short-tailed albatrosses (*Phoebastria albatrus*) also visit the NWHI each year, no incidental catches of this species have been reported in the Hawaii longline fishery (NMFS 1999). The Pacific population of the short-tailed albatross is about 1,100, and this species is listed as endangered in most of the US under the US Endangered Species Act of 1973 (Public Law 97-304; 16 U.S.C. 1536). Short-tailed albatrosses have been killed by the longline fleet in Alaska (NMFS 1998a), and it is possible that interactions could occur with Hawaii-based vessels.

Data collected by NMFS observers show that when Hawaii-based longline vessels target swordfish the incidental catch of seabirds is far higher than when vessels target tuna (Table 5.2): One reason for this is that vessels targeting swordfish (*Xiphias gladius*) are more likely to operate within the foraging range of the seabirds. Black-footed and Laysan albatrosses nesting in the NWHI forage predominantly to the north and northeast of the Hawaiian Archipelago, flying as far as Alaska or the western coast of the contiguous US (Anderson and Fernandez 1998; Cousins and Cooper in prep.). The region of greatest interaction between seabirds and the longline fishery is a latitudinal band between 25° N. and 40° N. stretching from the international dateline to about 150° W. (NMFS unpub. data). This band, referred to as the North Pacific Transition Zone, contains a broad, weak, eastward flowing surface current composed of a series of fronts situated between the Subtropical Gyre to the south and Subarctic Gyre to the north (Roden 1980; Seki *et al.* in prep). The convergent fronts are zones of enhanced trophic transfer with high concentrations of phytoplankton, zooplankton, jellyfish and squid (Bakun 1996; Olson *et al.* 1994). The increased level of biological productivity in these zones attracts, in turn, higher trophic level predators such as swordfish and seabirds (Section 14.4.2). Hawaii longline vessels targeting swordfish set their lines where the fish are believed to be moving south through the fronts following squid, the primary prey of swordfish (Seki *et al.* in prep.). Squid is also the primary prey item for the albatrosses (Harrison *et al.* 1983). Hence, the albatrosses and the longline vessels targeting swordfish are often present at the same time in the same northern front of high biological productivity.

Table 5.2. Incidental catch of albatrosses in the Hawaii longline fishery by set type based on NMFS observer records from 1994-1998.

Targeted Fish During Set	Observed Bird Catch	Number of Observed Sets	Bird Catch/Set
Swordfish	370	488	0.758
Mixed (Swordfish and Tuna)	472	946	0.499
Tuna	16	1,250	0.013

Source: NMFS, SWFSC Honolulu Laboratory.

It is also possible that albatrosses nesting in the NWHI forage predominantly to the north and northeast of the Hawaiian Archipelago because ocean surface winds tend to seasonally

diminish near the equator (Peixoto and Oort 1992). Because albatrosses are dependent upon these winds to dynamically soar over the ocean surface (Magnan 1925), it may be less energy efficient for these birds to forage at more southern latitudes. Bird counts made by the NOAA research vessel *Townsend Cromwell* in the tropical latitudes south of Hawaii confirm that albatrosses are rarely encountered south of 25° N. (C. Boggs, pers. comm.). Further, satellite tagging of both breeding Laysan and black-footed albatrosses by Wake Forest University has shown that these birds consistently fly either north or northeast from the Hawaiian Islands when foraging (Anderson and Fernandez 1998).

A second reason that longline vessels targeting swordfish incidentally catch a larger number of seabirds than vessels targeting tuna relates to differences in gear configuration and the depth and time of gear deployment. Longline gear targeting swordfish generally consists of fewer hooks between floats (3-5), branch line (gangion) weights attached further from the hooks and buoyant chemical light sticks. During swordfish fishing the longline is set at a shallow depth (5-60 m), and the line and baited hooks sink comparatively slowly. Consequently, albatrosses following behind a vessel targeting swordfish have a greater opportunity to dive on hooks and become caught. In addition, vessels targeting swordfish often set their lines in the late afternoon or at dusk when the foraging activity of seabirds may be especially high.

Vessels targeting tuna differ from those targeting swordfish in that they generally operate in warm waters further south and set their lines at a relatively deep depth (15-180 m or greater). To facilitate the deployment of fishing gear at these depths vessels usually increase the longline sink rate by employing a hydraulic line-setting machine (line-shooter or line-setter) and branch lines with 40-80 gram weights attached close (20-90 cm) to the hooks. The use of a line-setting machine and weighted branch lines to increase the longline sink rate also reduces the incidental catch of seabird by decreasing the time that baited hooks are near the surface and accessible to feeding seabirds.

Some longline sets target both swordfish and bigeye tuna (*Thunnus obesus*) and are called "mixed" sets. These sets are typically made with a modified swordfish gear configuration and without the use of a line-shooter.

## **6.0 Management Objectives**

The objective of this management action is to mitigate the harmful effects of fishing by Hawaii-permitted longline vessels on seabirds. Achieving this objective would reduce a source of mortality for Laysan and black-footed albatross populations in the NWHI, and reduce the risk of interactions between longline vessels and the endangered short-tailed albatross. This objective is consistent with the Magnuson-Stevens Fishery Conservation and Management Act which requires consistency with other applicable legislation and defines the term conservation and management as referring to all of the rules, regulations, conditions, methods and other measures which are required to rebuild, restore or maintain any fishery resource and the marine environment and which are designed to assure that irreversible or long-term adverse effects on fishery resources and the marine environment are avoided. Further, the US has adopted similar regulatory measures for reducing incidental catch of albatrosses and other seabirds in the

groundfish and Pacific halibut fisheries off Alaska (63 CFR 11161, March 6, 1998).

This objective is also consistent with US international policy. The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), of which the US is a member, has adopted mitigation measures to reduce the incidental catch of seabirds in commercial fisheries in the Southern Ocean. In addition, the US has participated over the past two years in an international initiative developed from the United Nations Food and Agriculture Organization Committee on Fisheries (FAO-COFI) to reduce the incidental catch of seabirds in longline fisheries worldwide. The FAO-COFI initiative is referred to as the International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA-SEABIRDS), and complements other FAO-COFI International Plans of Action for managing shark fisheries, and reducing fishing capacity. The IPOA-SEABIRDS calls for concerned countries with longline fisheries to conduct an assessment to determine if a problem exists with respect to the incidental catch of seabirds. If a problem exists, countries should develop a national plan containing the following elements: 1) mitigation methods of proven efficiency and cost-effectiveness; 2) research and development plans to improve and develop mitigation measures and evaluate their effectiveness; 3) education, training and publicity programs to improve the understanding of the problem resulting from the incidental catch of seabirds and the use of mitigation measures; and 4) data collection programs to determine the incidental catch of seabirds in longline fisheries and the effectiveness of mitigation measures.

## **7.0 Initial Actions**

Measures taken by the Council in the early 1990s to manage the pelagic species fishery also had the additional effect of reducing the incidental catch of seabirds by Hawaii-based longline vessels. These measures include limiting the size of the longline fleet and prohibiting longline fishing in a 50 nautical mile area (protected species zone) around the NWHI. Specific action by the Council to reduce the incidental catch of seabirds began in 1996 when the Council and the US Fish and Wildlife Service (USFWS) conducted a workshop in September of that year in Honolulu to inform longline fishermen of the problem and various mitigation measures. The book *Catching Fish, Not Birds* by Nigel Brothers (1995) was translated into Vietnamese and Korean and copies were sent to all holders of a NMFS Hawaii longline limited access permit. A second workshop informing fishermen of the problem was held in January 1997. At that time, the USFWS also distributed a laminated card showing various species of albatross and describing possible mitigation methods. The card was issued in both English and Vietnamese.

Assessments of the level of voluntarily adoption of mitigation measures by Hawaii longline fishermen indicated that the education program described above was only partially successful. Two dockside visits by Council and USFWS staff in mid-1997 to examine what mitigation measures, if any, were being employed revealed that, of the 12 longline vessels surveyed, five used weighted hooks, one used bait dyed blue to camouflage it in the water, three towed a trash bag or buoy, one scared birds with a horn, one distracted the birds by strategically discarding offal and two vessels took no measures. A mail survey of 128 Hawaii-based longline vessels was conducted by the Environmental Defense Fund during the same period. Ten of the 18 fishermen that responded to a question regarding mitigation measures employed indicated that



they were actively using some type of measure, such as reducing the use of deck lights at night, adding weights to increase the sink rate of the fishing line during setting, strategically discarding offal to distract birds, using a line-setting machine or setting the line under-water.

In October 1997, NMFS observers deployed on Hawaii-based longline vessels began recording which mitigation measures, if any, were being used voluntarily by fishermen. Information from the observer program for 1998 showed that nearly all vessels used some measure, the most common being to avoid setting the line in the vessel wake. About 55% of the vessels thawed the bait before baiting hooks, 29% of the vessels set at night and 11% avoided discarding unused bait while setting the fishing line. Only two percent of the vessels used a towed deterrent or blue-dyed bait.

A biological consultation under Section 7 of the Endangered Species Act was initiated by the NMFS in 1999 to determine the effects of the Hawaii-based longline fleet on the short-tailed albatross and is currently ongoing. A recently completed biological assessment by the NMFS, Pacific Islands Area Office (PIAO) has estimated that 15 short-tailed albatrosses have visited the NWHI over the past 60 years (NMFS 1999). The assessment noted that the historical range of the short-tailed albatross was known to include the waters near China, Japan, Korea, Russia, West Coast of the US and British Columbia, Canada. Historically, this bird was called the coastal albatross because of the numerous sightings of the short-tailed albatross near coastlines. Even though there is a history of wrecked vessels and visits by naturalists (H. Palmer and G. Munro) to Midway Atoll, NWHI, between 1859 to 1891 (i.e., prior to the species being harvested to near extinction by Japanese settlers between 1880 and 1932), the assessment reported that the first sighting of a short-tailed albatross in the NWHI was in 1938. The assessment concluded that, at present, the chance of an interaction between a longline vessel and a short-tailed albatross is extremely low, but it would be reduced further if mitigation measures were employed by longline vessels. The assessment also noted that the risk of interactions with fisheries could increase if the short-tailed albatross population grows and the range of the species might expand to include its historical range along the west coast of North America.

In October 1998, a seabird population biology workshop was convened in Honolulu to make a preliminary assessment of the impact of fishing by the Hawaii-based longline fleet on the black-footed albatross population in the NWHI. The incidental catch of seabirds by fishing vessels was identified as a source of chronic or long term mortality. It was noted that the impact of the interactions would be more serious if the albatrosses killed were predominantly adult birds because this would result not only in the loss of chicks, but also the loss of many breeding seasons as the surviving mate must find another mate and establish a pair bond. However, banding data analyzed at the workshop suggested that it is predominantly immature juvenile birds that are interacting with longline boats. This finding is consistent with that of Brothers (1991), who observed that about four times as many juvenile as adult albatrosses are caught in the Southern Bluefin tuna (*Thunnus maccoyii*) longline fisheries.

In anticipation that regulatory measures would be required to further reduce the incidental catch of seabirds in the Hawaii longline fishery, the Council in 1998 contracted Garcia and Associates to assess which mitigation methods would be most effective for local vessels under

actual commercial fishing conditions. As reported in McNamara *et al.* (1999), the study assessed the effectiveness of various mitigation methods aboard Hawaii-based longline vessels under actual fishing conditions. The mitigation techniques evaluated included several of those identified by Alexander, Robertson and Gales (1997) as being effective in other fisheries, such as night setting, towed deterrents, modified offal discharge practices and thawed bait. In addition, Garcia and Associates evaluated blue-dyed bait, the effectiveness of which appeared promising based on limited use by Hawaii-based longline vessels, but which had not been scientifically assessed. Because data collected by NMFS observers show that Hawaii-based longline vessels targeting swordfish had higher incidental catches of seabirds than did vessels targeting tuna (Table 5.2). Garcia and Associates tested the effectiveness of mitigation measures primarily during swordfish trips. The criteria used by Garcia and Associates to evaluate the effectiveness of mitigation measures included the number of attempts on (chases, landings and dives) and interactions (physical contact) with fishing gear as well as actual hookings and mortalities.

In early 1999, the NMFS, SWFSC Honolulu Laboratory assessed the effectiveness of several seabird mitigation methods during a cruise on a NOAA research vessel in the waters around the NWHI (Boggs in review). This study was designed to supplement the field test of towed deterrents and blue-dyed bait conducted by Garcia and Associates, and to evaluate an additional measure: weighted branch lines. The advantage of using a research vessel to test the effectiveness of mitigation measures was that fishing operations could be controlled to improve the opportunities for observation, comparison and statistical analysis. For example, by setting gear in daylight researchers greatly increased the number of bird interactions with the gear in the presence and absence of each mitigation method. Easily regurgitated net pins were substituted for hooks in the research to avoid injuring seabirds.

Based on observer records from 1994 to 1998, the NMFS, SWFSC Honolulu Laboratory also assessed the mitigative effectiveness of a line-setting machine used in combination with weighted branch lines (Table 5.2).

## **8.0 Management Alternatives**

During the 16-18 June 1999, Council meeting the Council requested that NMFS provide analyses of the ecological and economic impacts of the mitigation measures evaluated by Garcia and Associates and the NMFS, SWFSC Honolulu Laboratory. In addition, the Council requested that a range of geographical areas in which the measures would be applied be considered in the impact analyses in order to determine the geographical area that would offer the greatest protection for seabirds with the least negative economic impact on fishermen. The geographical areas considered were: 1) above 25° N.; 2) above 23° N.; 3) within the EEZ around the Hawaiian Islands; 4) within the EEZ around the Hawaiian Islands above 23° N.; and 5) within the EEZ around the Hawaiian Islands above 25° N.

These mitigation measures and management areas were combined to create four management alternatives. The alternatives range from taking no action (Alternative 1) to prohibiting longline fishing within the EEZ above 23° N. (Alternative 4). Alternatives 2 and 3 allow longline fishing within the EEZ but require that vessel operators utilize two or more

mitigation measures; the difference between the two alternatives being that Alternative 2 allows the fishermen to select which measures to employ while Alternative 3 assigns this decision to the Council.

**8.1 Alternative 1: No Action.**

**8.2 Alternative 2 (preferred alternative):** For all vessels registered for use under a Hawaii longline limited access permit operating with longline gear, vessels captains must 1) select and employ two or more of the mitigation measures in Table 8.1 when fishing above 25° N.; 2) follow proper handling techniques to increase the likelihood that birds brought onboard alive are released in a manner that ensures their long-term survival(See Appendix I); and 3) annually attend a protected species educational workshop conducted by the National Marine Fisheries Service.

**8.3 Alternative 3:** Same as Alternative 2 except that the Council selects for all vessels the two or more mitigation measures to be employed.

**8.4 Alternative 4:** Fishing with longline gear is prohibited within the EEZ around the Hawaiian Islands above 23° N.

Table 8.1. Description of mitigation measures evaluated by Garcia and Associates (McNamara *et al.* 1999), Boggs (in review) and NMFS, SWFSC Honolulu Laboratory.

Mitigation Measure	Description
<b>A. Discharge offal strategically:</b>	While gear is being set or hauled, fish, fish parts or bait must be discharged on the opposite side of the vessel from which the longline is being set or hauled. If a swordfish is landed, the liver must be removed and the head must be severed from the trunk, the bill removed and the head cut in half vertically. The heads and livers must be periodically thrown overboard on the opposite side of the vessel from which the longline is being set or hauled. Because the supply of offal may be low when fish catch rates are low or tuna are the target species, this mitigation method requires the preparation and storage of offal for use during the longline set, especially when catches are low. The intent of this measure is to divert seabirds from baited hooks to other food sources.
<b>B. Night setting:</b>	The longline set must begin at least one hour after sunset and be completed at least one hour before sunrise, using only the minimum vessel's lights necessary for safety. The purpose of setting fishing gear during hours of darkness is to reduce the visibility to seabirds of baited hooks at the water's surface.
<b>C. Blue-dyed and thawed bait:</b>	An adequate quantity of blue dye must be maintained on board, and only bait dyed a color that conforms to Council/NMFS standards may be used (See Appendix I). All bait must be completely thawed before the longline is set. The objective of dyeing bait blue is to reduce the attractiveness to seabirds of baited hooks at the water's surface. In addition, completely thawed bait tends to sink faster than frozen bait during the longline set, thereby reducing the time that baited hooks are accessible to seabirds.
<b>D. Towed deterrent:</b>	A line with suspended streamers (tori line) or a buoy that conforms to Council/NMFS standards must be deployed when the longline is being set and hauled (See Appendix I). These devices scare seabirds from baited hooks at the water's surface as well as provide a physical barrier that reduces the ability of seabirds to approach the hooks.
<b>E. Weighted branch lines:</b>	At least 45 grams of weight must be attached to branch lines within one meter of each baited hook. The purpose of attaching weights to branch lines is to increase the sink rate of baited hooks, thereby reducing the availability of baited hooks to seabirds.
<b>F. Line-setting machine with weighted branch lines:</b>	The longline must be set with a line-setting machine (line shooter) so that the longline is set faster than the vessel's speed. In addition, weights of at least 45 grams must be attached to branch lines within one meter of each baited hook. The purpose of this measure is to remove line tension during the set, thereby increasing the mainline sink rate and reducing the time that baited hooks are at the surface and accessible to seabirds.

## **9.0 Consistency with National Standards for Fishery Conservation and Management**

National Standard 1 states that conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry. The preferred management measure is not expected to have a significant effect on fish stocks or optimum yield (Section 10.1.4.3).

National Standard 2 states that conservation and management measures shall be based upon the best scientific information available. The preferred management measure is based on scientific information collected from assessments of the effectiveness of measures to reduce the incidental catch of seabirds in the Hawaii longline fishery and other fisheries outside the Western Pacific Region (Section 7.0).

National Standard 3 states that, to the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination. The preferred management measure is not expected to have a significant effect on the management of fish stocks as a unit.

National Standard 4 states that conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges. The preferred management measure is not expected to discriminate between residents of different States or allocate fishing privileges among fishermen.

National Standard 5 states that conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose. The preferred management measure is not expected to have a significant effect on efficiency (Section 10.3).

National Standard 6 states that conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources and catches. The preferred management measure is not expected to have a significant effect on fishery resources or catches of target species (Section 10.1.3.4).

National Standard 7 states that conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication. Although some mitigation methods can lead to negative economic impacts on certain vessel operations, the preferred management measure minimizes these impacts by allowing fishing vessel operations to choose which methods they use at any given time (Section 10.3.)

National Standard 8 states that conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing

communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities. Although some mitigation methods can lead to negative economic impacts on certain vessel operations, the preferred management measure minimizes these impacts by allowing fishing vessel operations to choose which methods they use at any given time (Section 10.3.) It is likely that those vessels which already set at night (primarily vessels targeting swordfish) would adopt night setting as one of their mitigation methods, while those vessels that already use a line-setting machine and weighted branch lines (primarily vessels targeting tuna) would employ this mitigation method. Furthermore, the use of strategic offal discharge, blue dyed bait or towed deterrents has a negligible impact on catch rates, and the direct cost of employing these mitigation methods is relatively low.

National Standard 9 states that conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch. The preferred management measure could result in a reduction in the take of sea turtles in the Hawaii longline fishery. The results of a study of the dietary preferences of sea turtles suggest that the use of blue-dyed bait by Hawaii-based longline vessels may reduce the incidental take of turtles (Section 10.1.4.2). Furthermore, the use of a line-shooter with weighted branch lines may reduce turtle interactions by decreasing the time that baited hooks are near the surface and accessible to feeding turtles (Section 10.1.4.2). The recommended measure is expected to significantly reduce the catch of seabirds in the Hawaii-based longline fishery (Section 10.1.4.1.3.2). This measure is not expected to significantly change the catch composition of the Hawaii longline fleet or increase its levels of fish bycatch.

National Standard 10 states that conservation and management measures shall, to the extent practicable, promote the safety of human life at sea. The addition of weight near the hook can be a danger to fishermen if hooks are suddenly pulled loose by the weight of a captive fish. One of the mitigation methods that fishermen may select under the recommended alternative is the attachment of a weight of at least 45 grams at a distance of one meter from the hook. Night setting is another mitigation method that could be dangerous if vessels are not equipped for this type of operation. However, the preferred management measure does not require that all vessels utilize weights or set at night; rather, it allows vessel operators to employ these mitigation methods at their discretion. It is expected that vessels will employ those mitigation methods which will not compromise the safety of human life at sea.

## **10.0 Relationship to Other Applicable Laws and Provisions of the Magnuson-Stevens Act**

### **10.1 National Environmental Policy Act (NEPA)**

This section has been prepared in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969 to assess the impacts on the human environment that may result from the proposed action. The Environmental Assessment (EA) provided here presents a brief analysis of the environmental impacts of the proposed action and its alternatives. NEPA requires preparation of an Environmental Impact Statement if the EA does not support a

finding of no significant impact.

#### **10.1.1 Purpose and need for action**

The purpose and need for action are described in Section 5.0.

#### **10.1.2 Alternatives**

The alternative management measures considered by the Council are described in Section 8.0.

#### **10.1.3 Affected environment**

##### **10.1.3.1 Seabirds**

The current world estimates of the number of breeding pairs of black-footed albatrosses and Laysan albatrosses are 61,866 and 558,415, respectively (Cousins and Cooper in prep.). Ninety-six percent of black-footed albatross nesting sites and more than 99% of Laysan albatross nesting sites are in the Northwestern Hawaiian Islands (NWHI). As the number of juvenile (i.e., non-breeding) albatrosses may be five to six times the number of adult (i.e., breeding albatrosses) (Pradel 1996), the total world populations for black-footed and Laysan albatrosses are estimated to be 300,000 and 2.4 million, respectively (Cousins and Cooper in prep.).

USFWS census data show that during the last decade the number of breeding pairs of black-footed albatrosses in nesting colonies in the NWHI have increased by about eight percent. However, some nesting colonies have experienced fluctuations. Between 1987 and 1988, the number of active black-footed albatross nests at French Frigate Shoals decreased from 5,067 to 4,535. This 11.7% decline represented approximately 7% of the total NWHI black-footed albatross population. Since 1997, however, the number of active nests at French Frigate Shoals has increased by 20.2%. Recent counts of black-footed albatross breeding pairs on Laysan Island, which is the largest nesting colony for black-footed albatrosses and accounts for more than one-third of the world's population of this species, indicate an increase of 4.2% since 1997. On the other hand, counts of black-footed albatross breeding pairs on Midway Atoll between 1996 and 1998 show a decline of 5.5%. Yet, over a period of eight years (1991-1998) the number of black-footed Albatross pairs on Midway Atoll has increased by 3.7%. The number of breeding pairs of Laysan albatrosses in nesting colonies in the NWHI has also fluctuated, with Laysan Island showing a 26% increase in breeding pairs between 1991 to 1996 followed by a 60% decline between 1996 and 1998. Overall, between 1991 to 1998, it is estimated that the number of Laysan albatross breeding pairs in the NWHI decreased by at least ten percent. In general, the number of albatross breeding pairs in the NWHI has been fluctuating or decreasing over the last decade, even though human activities have been reduced at most of the nesting colonies.

The slow recovery of NWHI albatross nesting colonies to historical levels may be related, at least in part, to the incidental catch of seabirds in longline fisheries. In addition, fluctuations in

overall ecosystem productivity would also impact the recovery of seabird populations (Polovina *et al.* 1994). Recent evidence from population studies and modeling exercises suggests that the combination of domestic and foreign longline fisheries in the North Pacific have had a negative impact on the NWHI albatross populations (Cousins and Cooper in prep.). Although the emphasis of research to date has been on the impacts of fishing operations on the black-footed albatross population, the modeling exercises conducted at the black-footed Albatross Population Biology Workshop in 1998 can be applied to both black-footed and Laysan albatross populations. One finding of the workshop modeling exercises suggests that the sustained growth rate of an albatross population (without any fishing-related mortality) is in the range of zero to about four percent. The modeling exercises also showed that the growth rate of the population will be reduced by an equivalent percentage of the total number of birds killed in the longline fisheries each year. This estimated reduction in growth is a robust estimate in that it is not sensitive to the ratio of juveniles to adults lost, nor is it sensitive to whether the population was growing at zero or four percent. This means that if the total number of birds killed in the longline fisheries each year is of the order of one percent of the total population, then the growth rate of the population will be reduced by slightly more than one percent.

The average annual incidental catches of black-footed and Laysan albatrosses in the Hawaii longline fishery represent about 0.6% and 0.06% of the total estimated populations of these species, respectively. This source of seabird mortality cannot account for all of the declines in the number of NWHI breeding pairs described above. Although it is known that foreign longline vessels are operating in the foraging areas of the albatrosses close to the northern boundary of the US EEZ around the NWHI (Cousins and Cooper in prep.), the number of seabirds killed by these vessels is unknown. Other anthropogenic sources of mortality occur at the NWHI seabird nesting colonies, such as at Midway Atoll where seabird deaths take occur as a result of birds striking buildings, aircraft, vehicles, trees or high tension wires, or becoming entangled in recreational fishing gear. The number of seabirds killed by these causes is unknown, but it is probably small relative to the mortality resulting from longline fisheries.

Given that albatrosses can live for at least 40 years and may skip a breeding season to molt (Cousins and Cooper in prep.), a thorough assessment of the impacts of a single mortality source, such as longline fishing by Hawaii-based vessels, requires long term monitoring of seabird population demographics. Juvenile seabirds are caught more often than adults in longline fisheries (Brothers 1991; Boggs in review; Cousins in review) and since albatrosses have long maturation periods (up to five years) during which juveniles do not return to the nesting colony, the impacts of the incidental catch of seabirds in longline fisheries on seabird populations may not be detected for several years. To fully understand the impacts of longline fisheries on black-footed and Laysan albatross populations, modelers need to include age-specific survivorship and recruitment rates for both species. Again, due to the life history traits of these albatrosses, considerable time may lapse before the implementation of measures to reduce the incidental catch of seabirds in the Hawaii longline fishery results in measurable changes in the size and recruitment rates of NWHI albatross populations. Understanding the causes of these changes will be hampered by the fact that the Hawaii-based longline fleet is not the only fishery impacting the NWHI albatrosses, nor are fisheries the only possible causes for the observed fluctuation in



numbers. Consequently, long-term monitoring of NWHI breeding colonies coupled with international data sharing agreements is necessary to fully understand the impact of mitigation measures on albatross populations.

The short-tailed albatross has the smallest population of any albatrosses in the North Pacific, and this species is listed as endangered under the Endangered Species Act. A biological consultation under Section 7 of the Endangered Species Act was initiated by NMFS in 1999 to determine the effects of the Hawaii-based longline fleet on the short-tailed albatross. This consultation is still ongoing. A biological assessment completed by the NMFS Pacific Island Area Office concluded that, at present, the chance of an interaction between a Hawaii-based longline vessel and a short-tailed albatross is extremely low, but would be reduced further if mitigation measures were employed by longline vessels (NMFS 1999). According to sighting records, 15 short-tailed albatrosses have visited the NWHI over the past 60 years, with five of these birds visiting between 1994 and 1999 (NMFS 1999).

#### 10.1.3.2 Sea turtles

All sea turtles are designated under the US Endangered Species Act as either threatened or endangered. The breeding populations of the Mexico olive ridley (*Lepidochelys olivacea*) are currently listed as endangered. Also listed as endangered are the leatherback turtles (*Dermochelys coriacea*) and hawksbill turtles (*Eretmochelys imbricata*). Green sea turtles (*Chelonia mydas*) and loggerhead turtles (*Caretta caretta*) are listed as threatened, but are afforded the same protection as endangered sea turtles.

The populations of several species of sea turtles have declined in the Pacific as the result of nesting habitat loss and excessive and widespread harvesting for commercial and subsistence purposes (Eckert 1993). Leatherbacks and loggerheads are the species of principal concern with regard to incidental take in Pacific pelagic longline fisheries. These fisheries are conducted mainly by Japan, Taiwan, Korea and the US. There are only two populations of loggerhead turtles in the Pacific, one originating in Australia where serious declines are occurring, and the other in southern Japan (Eckert 1993). Leatherbacks inhabiting the Pacific mainly originate from nesting beaches in Mexico and Costa Rica where significant declines have been documented; from Indonesia where their status is uncertain but possibly stable; and from Malaysia where the nesting colony is nearly extinct despite 30 years of conservation measures (Eckert 1993).

It is estimated that in 1998 the Hawaii longline fishery interacted with 174 leatherbacks and 363 loggerheads. Both of these species are mainly taken by longline vessels fishing north of the Hawaiian Islands where the incidental catch of seabirds is the highest (Kleiber 1998a; Kleiber 1998b). A NMFS biological opinion on the effects of the Hawaii pelagic longline fishery on sea turtle populations (NMFS 1998) concluded that the continuing operation of the fishery was not likely to jeopardize the continual existence and recovery of any sea turtles. However, NMFS is required to continue monitoring the incidental takes and mortality of sea turtles and seek ways to reduce them. Data for monitoring take levels and factors that affect takes are collected through a NMFS observer program operated by the Southwest Region and mandatory longline logbooks

submitted to NMFS by longline vessel captains.

#### 10.1.3.3 Marine Mammals

All fisheries in the waters around Hawaii, including the longline fishery, are classified as Category III under Section 118 of the Marine Mammal Protection Act of 1972 (62 FR 28657, May 27, 1997). Endangered cetaceans that have been observed in the region where Hawaii longline vessels operate are the humpback whale (*Megaptera novaeangliae*), sperm whale (*Physeter macrocephalus*), blue whale (*Balaenoptera musculus*), fin whale (*B. physalus*) and the sei whale (*B. borealis*). Other cetaceans not classified as endangered but protected under the Marine Mammal Protection Act are occasionally encountered in the longline fishery. These species mainly consist of dolphins and the smaller beaked and toothed whales. Interactions between any species of cetaceans and the Hawaii longline fishery are rare. Between 1994 and 1998, NMFS observers recorded two entanglements involving a humpback whale and sperm whale. False killer whales occasionally strip the bait from longline hooks. To avoid this type of interaction Hawaii-based longline vessels that encounter false killer whales delay setting their lines until a sufficient distance between the vessel and the whale school has been achieved.

The Hawaiian monk seal (*Monachus schauinslandi*) is a tropical seal which was once widespread in the Hawaiian Islands. Today, between 1,200 and 1,450 seals are found mainly in the NWHI from Nihoa Island to Kure Atoll (Johanos and Ragen 1997). In 1976, the species was designated as depleted under the Marine Mammal Protection Act following a 50% decline in beach counts from the late 1950s to mid 1970s. The Hawaiian monk seal has also been listed as an endangered species under the ESA. In the late 1980s, the shoreline to a depth of 20 fathoms (37 m) around breeding areas in the NWHI and Maro Reef was designated as critical habitat for monk seals.

Evidence of interactions between monk seals and the Hawaii longline fishery began to accumulate in 1990, and included three hooked seals and 13 unusual wounds thought to have resulted from interactions. In 1991, NMFS prohibited longline fishing within a Protected Species Zone which extends 50 nautical miles around the NWHI and includes the corridors between islands. Subsequent to the establishment of the Protected Species Zone there have been no reports of interactions between monk seals and the Hawaii longline fishery.

#### 10.1.3.4 Targeted finfish and related stocks

The Hawaii-based longline fleet target pelagic fish that are capable of extensive movement and are also caught by foreign fleets and other types of domestic vessels operating in various EEZs and the high seas. The stocks of the principal species targeted or caught incidentally by these fleets (bigeye and swordfish), are thought to be in good condition. However, inadequate information on bigeye tuna mortality and exploitation rates makes it difficult to authoritatively determine the status of bigeye stocks. Studies indicate that there is little, if any, separation between eastern and western bigeye tuna stocks. Further, bigeye catch per thousand hooks (CPUE) of longliners operating in the eastern Pacific has been decreasing

since 1990, while that for the western Pacific has been stable (Lewis and Williams 1999). The swordfish CPUE of Hawaii-based longline vessels appears to be strongly influenced by the subtropical convergence zone north of the Hawaiian Islands (Seki *et al.* 1999), and catches show little relationship to fishing effort (Kleiber 1999).

There are no signs that pelagic fisheries across the Pacific have had a negative impact on catches of incidental species in the longline fishery such as skipjack tuna (*Katsuwonus pelamis*) or yellowfin tuna (*Thunnus albacares*) (Lewis and Williams 1999). Variability in the yellowfin catch rates of domestic purse seine vessels is likely due to environmental conditions associated with *El Niño*-Southern Oscillation (ENSO) events and changes in target species and fishing grounds as the CPUE of domestic and foreign longline boats targeting yellowfin show no decline when standardized for habitat and gear effects (Bigelow 1999). Pacific albacore tuna (*T. alalunga*) are thought to be separated into northern and southern stocks, with little or no mixing (Murray 1992). The results of a 1997 assessment of the northern stock suggest that the current population size is greater than the stock size associated with the maximum sustainable yield (MSY).

While most studies suggest that billfish stocks are healthy, there is considerable uncertainty regarding the quality of the data and reliability of the methods used to evaluate fisheries trends. However, an assessment of the blue marlin (*Makaira mazara*) stock conducted by the Inter-American Tropical Tuna Commission suggest that the stock is healthy, with current levels of biomass and fishing effort near the levels required to maintain the MSY.

A comprehensive stock assessment of blue shark (*Prionace glauca*) in the north Pacific has not yet been completed, but an analysis of the blue shark CPUE of Japanese longliners from 1971 to 1993 revealed no evidence that the blue shark stock in the north Pacific is in a critical condition (Nakano and Seki in review). The blue shark CPUE of Hawaii-based longline vessels has also been stable over the past five years (Ito and Machado 1999).

#### **10.1.4 Environmental consequences of alternatives**

##### **10.1.4.1 Impacts on seabirds**

Section 10.1.4.1.1 summarizes the findings of assessments of the effectiveness of various mitigation methods analyzed by Garcia and Associates (McNamara *et al.* 1999), Boggs (in review) and NMFS, SWFSC Honolulu Laboratory. Section 10.1.4.1.2 examines the relative impacts on seabird populations of applying these mitigation measures to various management areas. Section 10.1.4.1.3 describes the overall environmental impacts of the four alternative management measures considered by the Council (Section 8.0).

##### **10.1.4.1.1 Effectiveness of mitigation measures**

###### **10.1.4.1.1.1 Offal discharge methods**

#### 10.1.4.1.1.1

#### Prohibit offal discharge during setting and hauling

Garcia and Associates (McNamara *et al.* 1999) report that the retention of offal on-board the vessel during the longline haul led to more attempts (chases, landings and dives) and interactions (physical contact with gear) than if the offal was discarded (Table 10.1). The retention of offal on-board may increase the hooking of seabirds by longline gear because there is no readily available alternative food source in the water during fishing operations that would distract seabirds from baited hooks. A similar finding was reported in a study of seabird bycatch in longline fisheries targeting Patagonian toothfish (*Dissostichus eleginoides*) in the southern Indian Ocean (Cherel and Weimerskirch-1995). Based on these observations by the Garcia and Associates, as well as the study by Cherel and Weimerskirch (1995), this mitigation measure does not appear to be effective.

Table 10.1. Garcia and Associates results: effectiveness of various mitigation measures in reducing seabird attempts, interactions and hookings during longline hauling. Values in parentheses are the number of attempts, interactions or hookings per thousand hooks corrected for the number of birds present.

Mitigation Measure	Percent Reduction in Attempts <sup>1</sup>	Percent Reduction in Interactions <sup>2</sup>	Percent Reduction in Hookings <sup>3</sup>
Prohibit offal discharge	-65 (25.5)	-15 (1.3)	26 (0.4)
Blue-dyed bait	67 (5.2)	93 (0.1)	100 (0)
Towed Deterrent - Tori line	92 (1.2)	93 (0.1)	57 (0.2)
Towed Deterrent - Towed buoy	87 (2.0)	85 (0.2)	62 (0.2)
Control	(15.5)	(1.2)	(0.5)

<sup>1</sup>Defined as a seabird chasing, landing near or diving on baited hooks but not coming into physical contact with fishing gear.

<sup>2</sup>Defined as a seabird coming into physical contact with baited hooks but not becoming hooked or killed.

<sup>3</sup>Defined as a seabird hooked but not necessarily killed.

Source: McNamara *et al.* 1999.

#### 10.1.4.1.1.2 Discharge offal strategically

The Cherel and Weimerskirch (1995) study reported that when offal was retained the

seabird mortality rate was high, but the release of homogenized offal during line setting reduced the incidental catch of seabirds by up to 92%. Garcia and Associates (McNamara *et al.* 1999) also reported that discharging offal strategically is an effective interaction mitigation measure during the longline set (Table 10.2). However, the researchers note that there is little or no offal generally available during setting operations. Further, the supply of offal may be low when fish catch rates are low or tuna are the target species. Consequently, this mitigation method requires the preparation and storage of offal for use during the longline set, especially when catches are low.

#### **10.1.4.1.1.2 Night setting**

Of all the interaction mitigation methods tested by Garcia and Associates (McNamara *et al.* 1999), night setting was the simplest measure to employ, and was found to reduce seabird mortalities during the longline set by 73% (Table 10.2). Overall, mortality of seabirds during night portions of setting operations are far lower than during daylight portions of sets.

Night setting is less effective in reducing interactions with Laysan albatross than with black-footed albatross, possibly because Laysan albatross are more likely to forage at night (Harrison and Seki 1987). The effectiveness of night setting as an interaction mitigation measure may be diminished if chemical light sticks are attached to branch lines as the light sticks may slow the sink rate of baited hooks and illuminate the bait. Aft-facing deck lights aboard the vessel or bright moonlight also can reduce the effectiveness of this measure by illuminating baited hooks at the water's surface.

#### **10.1.4.1.1.3 Blue-dyed and thawed bait**

Both Garcia and Associates (McNamara *et al.* 1999) and Boggs (in review) reported that blue-dyed bait was the most effective measure tested in mitigating seabird interactions and mortalities during the longline set (Table 10.2 and 10.3). Garcia and Associates (McNamara *et al.* 1999) noted that blue-dyed bait is also a highly effective mitigation measure during longline hauling even though soaking many hours in the water may cause the blue color of the bait to fade (Tables 10.1 and 10.2).

In the Garcia and Associates study (McNamara *et al.* 1999), both the control bait (undyed) and the treatment bait (blue-dyed) were completely thawed before use. Boggs (in review), however, found that blue-dyed bait is an effective mitigation measure even if the bait is used in a partially frozen condition (Table 10.3). However, bait must be completely thawed before it can be effectively dyed, and it is expected that commercial fishermen will generally not re-freeze the bait once it has been dyed. Thawed bait sinks faster than frozen bait during the longline set, thereby reducing the time that baited hooks are accessible to seabirds (Brothers *et al.* 1998).

#### **10.1.4.1.1.4 Towed deterrent**

Of all the mitigation methods tested by Garcia and Associates (McNamara *et al.* 1999), the tori line and towed buoy system were found to be the most effective measures to reduce attempts and interactions during hauling of the longline (Table 10.1); but towed deterrents are less effective mitigation measures during the longline set (Table 10.2). Boggs (in review) also found that a tori line was less effective than blue-dyed bait or weighted branch lines during the setting operations (Table 10.3). The researchers noted that some individual seabirds either are not scared away from baited hooks at the water's surface during their initial encounter with tori lines or towed buoys or lose their fear of these devices over time.

Garcia and Associates indicated that towed deterrents are less effective in reducing mortalities of Laysan albatross than mortalities of black-footed albatross, possibly because Laysan albatross have a more aggressive or methodical foraging behavior that causes them to continue to dive on baited hooks (McNamara *et al.* 1999). Garcia and Associates also noted that the effectiveness of towed deterrents may be greatly reduced in rough weather, and towed deterrents may become entangled with fishing gear if not closely monitored. An entanglement leaves baited hooks accessible to seabirds unless another towed deterrent is immediately deployed (McNamara *et al.* 1999).

Table 10.2. Garcia and Associates results: effectiveness of various mitigation measures in reducing seabird attempts, interactions and mortalities during longline setting. Values in parentheses are the number of attempts, interactions or mortalities per thousand hooks corrected for the number of birds present.

Mitigation Measure	Percent Reduction in Attempts <sup>1</sup>	Percent Reduction in Interactions <sup>2</sup>	Percent Reduction in Mortalities
Discharging offal strategically	62 (29.4)	53 (15.4)	86 (0.3)
Night setting	NA	NA	73 (0.6)
Blue-dyed bait	49 (39.3)	77 (7.6)	95 (0.1)
Towed Deterrent - Towed buoy	52 (37.1)	51 (16.1)	88 (0.3)
Towed Deterrent - Tori line	39 (47.1)	52 (15.7)	79 (0.5)
Control	(76.7)	(32.8)	(2.23)

<sup>1</sup>Defined as a seabird chasing, landing near or diving on baited hooks but not coming into physical contact with fishing gear.

<sup>2</sup>Defined as a seabird coming into physical contact with baited hooks but not becoming hooked or killed.

Source: McNamara *et al.* 1999.

#### 10.1.4.1.1.5 Weighted branch lines

Boggs (in review) reports that adding 60 g of weight to the branch lines reduced interactions by 92% (Table 10.3). Boggs also noted that the attachment of chemical light sticks to the weighted branch lines did not significantly reduce the sink rate of the baited hooks.

Table 10.3. NOAA research results: effectiveness of various mitigation measures in reducing seabird contacts during longline setting in tests aboard a NOAA research vessel.

Mitigation Measure	Percent Reduction in Contacts <sup>1</sup>
Blue-dyed bait (Thawed and partially frozen)	95
Tori line	76
Weighted branch line	92

<sup>1</sup>Defined as a seabird coming into physical contact with baited hooks with a high likelihood of being hooked.

Source: Boggs in review.

The sink rate of weighted branch lines was not measured by Boggs (in review). However, Brothers *et al.* (1995) report that the sink rate of frozen bait weighing 150 to 250 grams is 20 cm/sec when a 10 gram weight is attached and 40 cm/sec when a 50 gram weight is used. These sink rates were measured in 3 meter deep laboratory tanks and demonstrate that in still seawater, sink rates increase substantially with the addition of weight up to about 50 grams and level off as more weight is added.

Albatrosses are surface feeders and do not dive as deeply as smaller seabirds or seabirds that are specialized to plunge dive such as boobies (Bergin 1997; Brothers 1991; Brothers *et al.* 1999; Harrison *et al.* 1983). For example, the wandering albatross (*Diomedea exulans*) dive to a maximum depth of 0.6 m (Prince *et al.* 1994), and the shy albatross (*Thalassarche cauta*) dive to a maximum depth of 3.5 m (Hedd *et al.* 1997). Black-footed and Laysan albatross have been observed diving after sinking bait using an underwater video camera (C. Boggs, pers. comm.). The deepest dives observed were about 2 body lengths, which is equal to about 1.6 m. Because albatrosses are shallow divers, relatively small increases in hook sink rates could substantially reduce the incidental catch of seabirds by Hawaii-based longline vessels. According to Brothers *et al.* (1995), a frozen bait weighted with about 50 g of lead should sink to 3 m depth approximately 30 m behind a longline vessel setting at 8 knots.

#### 10.1.4.1.1.6 Line-setting machine with weighted

#### **branch lines**

The NMFS, SWFSC Honolulu Laboratory assessed the mitigative effectiveness of a line-setting machine used in combination with weighted branch lines (Table 5.2). NMFS observer records from 1994 to 1998 show that Hawaii-based longline vessels targeting tuna (0.013 birds hooked/set) have substantially lower seabird interactions than those vessels targeting swordfish (0.758 birds hooked/set). The use of a line-setting machine is often a key indicator of the branch line construction and terminal tackle, including the presence of a lead sinker within a meter of the hook which increases the sink rate of baited hooks. Although the actual sink rate of a baited hook deployed with a line-setting machine has not been measured, use of a line-setting machine is likely to increase the hook sink rate by removing line tension during the set. However, the use of a line-setting machine alone, without weighted branch lines, does not appear to increase the hook sink sufficiently to significantly reduce the incidental catch of seabirds (B. McNamara and J. Cook, pers. comm.).

#### **10.1.4.1.1.8 Summary of effectiveness of mitigation measures**

Overall estimates of the effectiveness of mitigation measures in reducing the incidental catch of seabirds in the Hawaii longline fishery (Table 10.4) were computed by averaging the impacts on seabird hooking found by Garcia and Associates (McNamara *et al.* 1999) (Tables 10.1 and 10.2), Boggs (in review) (Table 10.3), and by NMFS observers.

Studies of the effectiveness of an array of mitigation measures suggest that all of the measures presented in Table 10.4 have the potential to significantly reduce the incidental catch of albatrosses in the Hawaii longline fishery. On the other hand, no mitigation measure is totally effective on its own. Furthermore, combining use of mitigation measures is necessary if any single measure significantly loses its effectiveness under certain circumstances (e.g., night setting during a full moon or use of tori line during rough seas) or gradually loses its effectiveness (e.g., if seabirds become habituated to a particular towed deterrent, or blue-dyed bait). Combining use of two or more measures is highly likely to improve overall mitigation effectiveness, although it is uncertain by how much. Due to time constraints, each of these measures were only tested against a control, no combinations have yet been tested.



Table 10.4. Summary of estimated effectiveness of various mitigation measures in reducing the incidental catch of black-footed albatrosses (BF) and Laysan albatrosses (LA) in the Hawaii longline fishery.

Mitigation Measure	Species	Percent Reduction in Incidental Catch
Discharge offal strategically <sup>1</sup>	BF	83
	LA	91
Night setting <sup>1</sup>	BF	95
	LA	40
Blue-dyed bait <sup>1,2</sup>	BF	95
	LA	90
Towed deterrent <sup>1</sup>	BF	86
	LA	71
Weighted branch lines <sup>2,3</sup>	BF	93
	LA	91
Line-setting machine with weighted branch lines <sup>3</sup>	BF	98
	LA	97

Source: McNamara *et al.* (1999)<sup>1</sup>; Boggs in review<sup>2</sup>; NMFS, SWFSC Honolulu Laboratory<sup>3</sup>.

#### **10.1.4.1.2 Impacts of applying mitigation measures to various geographic management areas**

The actual impact of mitigation measures on seabird populations depends on where the measures are used. The Council examined the impact on the incidental catch of seabirds that would result from applying the mitigation measures in five potential geographic management areas (Options 1 to 5 in Section 8.0). Figures 10.1 A-E show the five management areas, percentage of total seabird catches occurring in each area and percentage of total fishing effort (i.e., fishing sets) that occur in each geographical area.

The preferred management area is above 25° N. (Option 1). This area would encompass 95% of the fleet's average annual incidental seabird catch and 33% of average annual fleet effort (Figure 10.1A). If one measure is used in the prescribed manner above 25° N., it is estimated that the incidental catch of seabirds in the Hawaii longline fishery would decrease by 58% to 91%, depending on which measure is used (Table 10.6.).

If the management area was all waters above 23° N. (Option 2), it would encompass 97% of the fleet's average annual incidental seabird catch and 44% of average annual fleet effort (Figure 10.1B). A comparison of the impacts of Option 1 and Option 2 reveals that an additional 11% of fishing effort would be impacted to reduce the incidental catch of seabirds by an additional two percent. Although Option 2 would include the waters around a seabird colony at French Frigate Shoals, the birds at this colony are already partially protected by the NWHI 50 nm longline vessel area closure (protected species zone) established in 1991. NMFS observer data show that seabird interaction rates are low outside the area closure between 23° N. and 25° N. (the area most directly surrounding French Frigate Shoals) as compared to above 25° N., for each type of set (swordfish, mixed, tuna) (Table 10.5).

Table 10.5. Incidental catch of albatrosses in the Hawaii longline fishery by area and set type based on NMFS observer records from 1994-1998.

	Bird Catch/Set	
	Black-footed Albatross	Laysan Albatross
<b>Above 25° N.</b>		
Swordfish	0.41	0.26
Mixed (Swordfish and Tuna)	0.35	0.32
Tuna	0.01	0.01
<b>Above 23° N.</b>		
Swordfish	0.38	0.24
Mixed (Swordfish and Tuna)	0.30	0.26
Tuna	0.01	0.01
<b>EEZ between 23°N. and 25°N.</b>		
Swordfish	0.05	0.00
Mixed (Swordfish and Tuna)	0.07	0.03
Tuna	0.00	0.00

Source: NMFS, SWFSC Honolulu Laboratory.

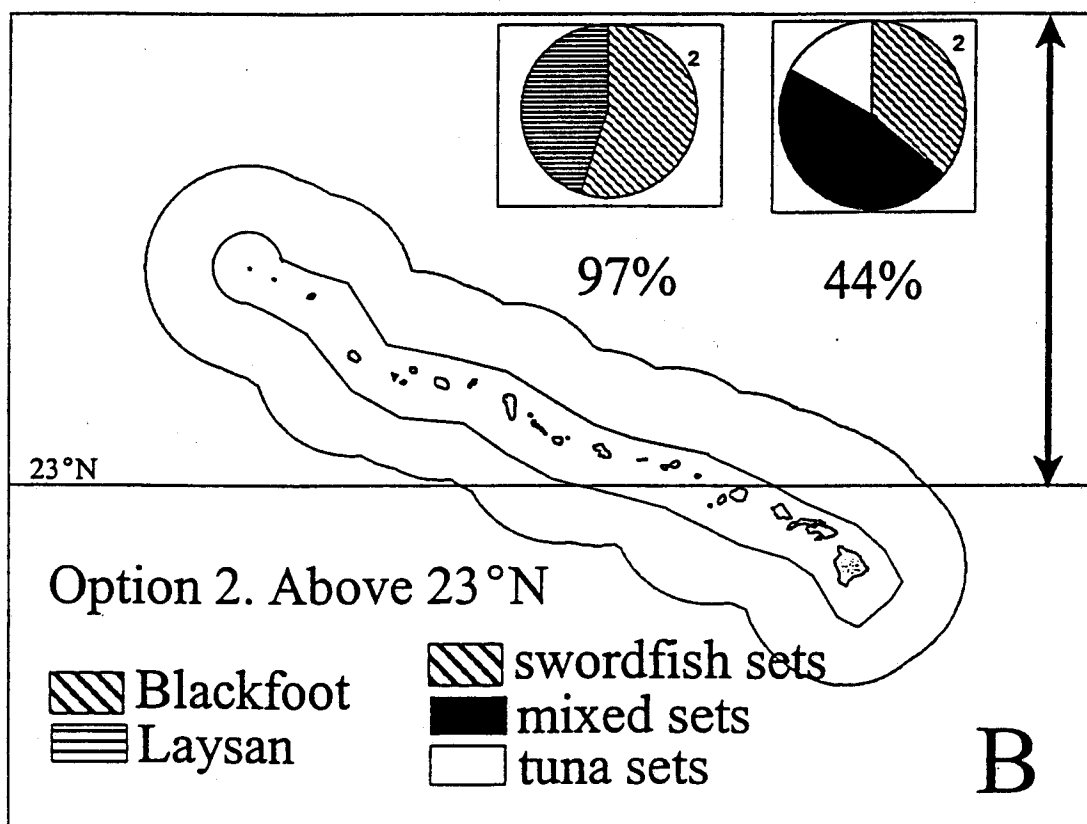
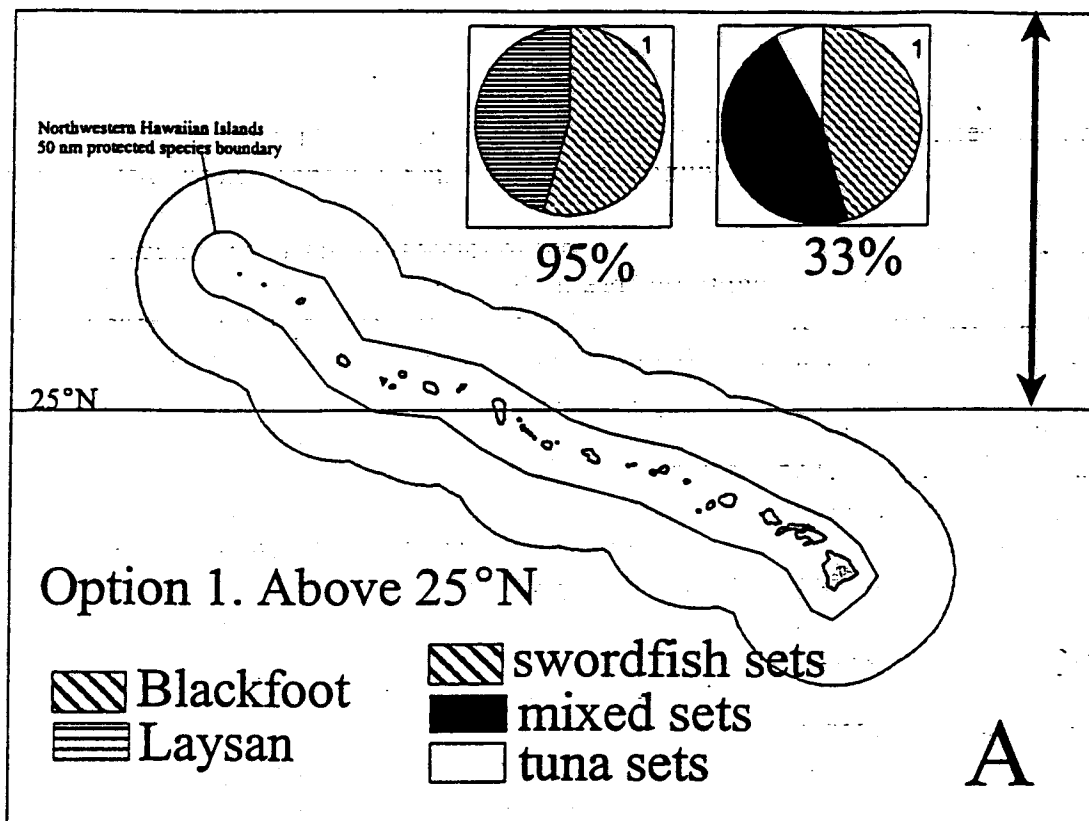
If the management area was all waters within the EEZ around Hawaii (Option 3), it would encompass 64% of the fleet's average annual incidental seabird catch and 56% of average annual fleet effort (Figure 10.1C). If one measure is used in the prescribed manner in this management area, it is estimated that the incidental catch of seabirds in the Hawaii longline fishery would decrease by 38% to 59%, depending on which measure is used (Table 10.6). Compared to Option 1, this management area would encompass an additional 23% of fleet effort, but 31% less of the fleet's average annual incidental seabird catch.

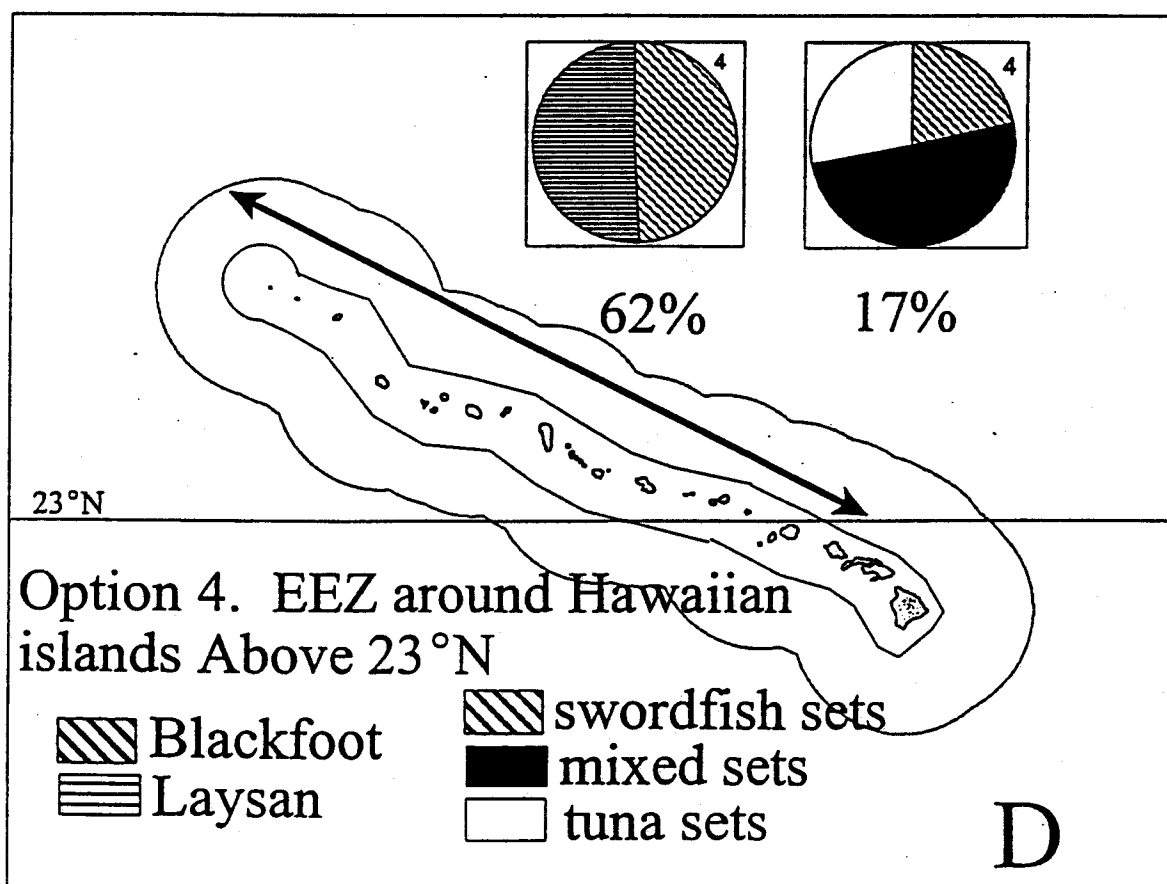
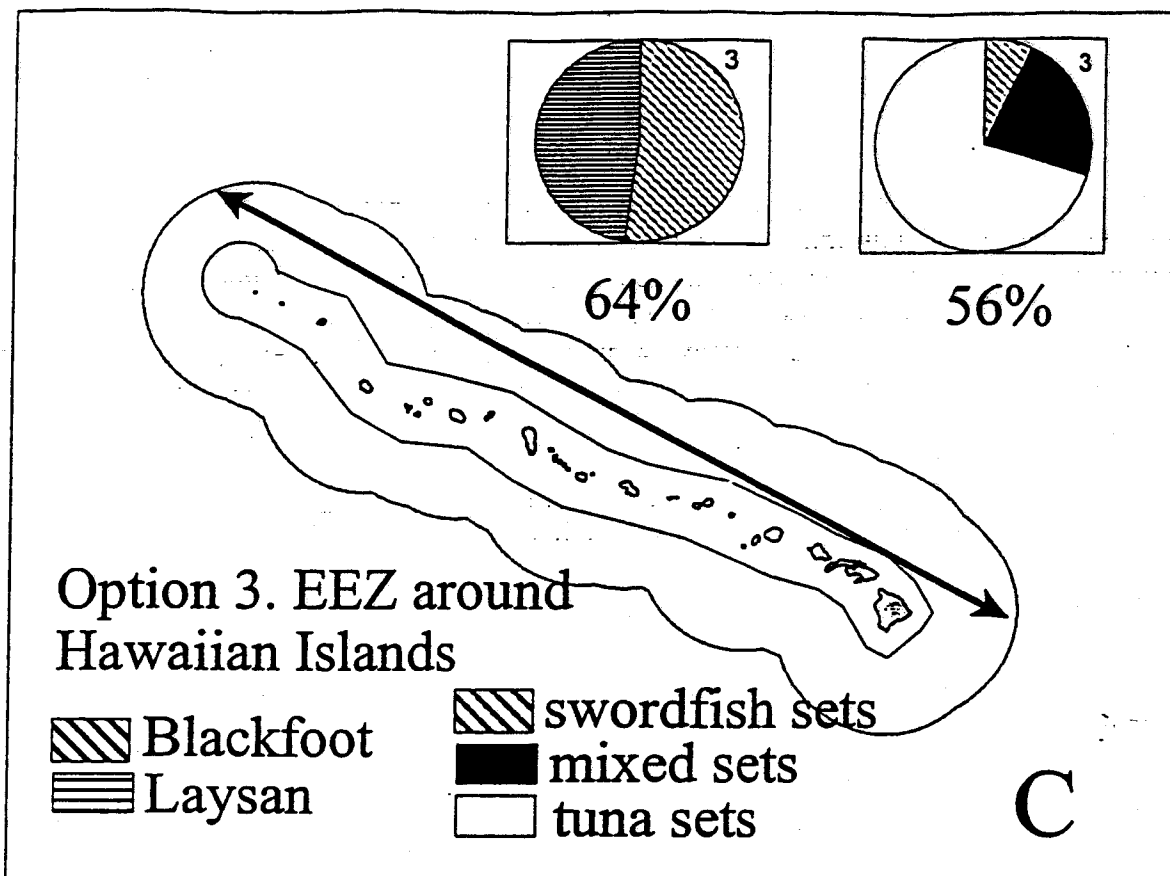
If the management area was all waters above 23°N. within the EEZ around Hawaii (Option 4), it would encompass 62% of the fleet's average annual incidental seabird catch and 17% of average annual fleet effort (Figure 10.1D). If one measure is used in the prescribed manner in this management area, it is estimated that the incidental catch of seabirds in the Hawaii longline fishery would decrease by 36% to 59%, depending on which measure is used (Table 10.6). Compared to Option 1, this management area would encompass an additional 16% of fleet effort but 33% less of the fleet's average annual incidental seabird catch.

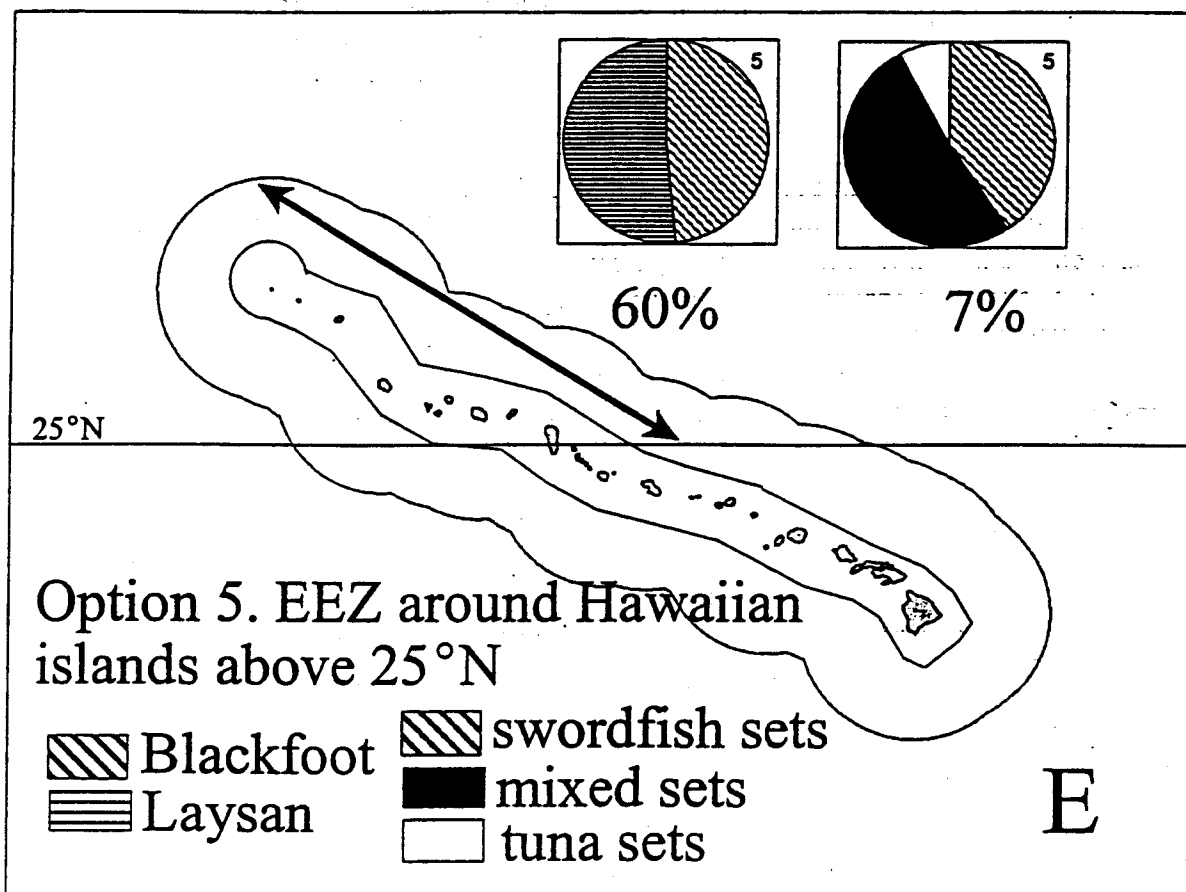
If the management area was all waters above 25°N. within the EEZ around Hawaii (Option 5), it would encompass 60% of the fleet's average annual incidental seabird catch and 17% of average annual fleet effort (Figure 10.1E). If one measure is used in the prescribed manner in this management area, it is estimated that the incidental catch of seabirds in the Hawaii longline fishery would decrease by 35% to 57%, depending on which measure is used (Table 10.6). Compared to Option 1, this management area would encompass an additional 26% of fleet effort but 35% less of the fleet's average annual incidental seabird catch.

The impact on the incidental catch of seabirds of applying the mitigation measures in each management area was calculated by first estimating total annual mortalities by management area. This was done by multiplying observed seabird interaction rates by average annual effort, to get estimated seabird catch by area. Area interaction rates (mortalities/set) were calculated by bird species and vessel target, based on 1994-1998 observer data. Area average effort (sets/year) by vessel target were taken from 1994-1998 logbooks. Estimated target specific seabird mortalities were then summed by area to get total annual seabird mortalities per area, by bird species. These specific area seabird mortalities were then reduced by the application of the mitigation measures in Table 10.4. These numbers were further adjusted (reduced) for the number of vessels already employing a given measure, such as a line-shooter with weighted branch lines, as they would be unaffected by a requirement for this measure. The estimated percent reduction in incidental seabird catch presented in Table 10.6 is the effect of the application of a given measure to a given area, measured as a percentage decline in total (fleet wide) incidental seabird catch. To summarize the calculations in the form of an equation:  $\text{Interaction Rate} \times \text{Effort} \times \text{Mitigation Rate} \times \text{Percent of Sets Affected} = \text{Percent Reduction in Total Incidental Bird Catch}$ . The estimated impacts for each management area are presented in Table 10.6.

Figure 10.1. Maps A - E show the five potential geographic management areas (Options 1 to 5 in Section 8.0). On each map are two pie charts showing the percentage of total seabird catches and the percentage of total fishing effort (i.e., fishing sets) that occur in each management area. Also shown on each map is the boundary of the EEZ for the Hawaiian Archipelago. The Hawaii longline fishery is regulated by the Council which prohibits longlining within 50 nautical miles of the Northwestern Hawaiian Islands and within seasonally-adjusted areas 25 to 75 nautical miles around the Main Hawaiian Islands. These areas are indicated by an inner boundary immediately surrounding the Hawaiian Islands.







**Table 10.6. Potential decrease in the total incidental catch of black-footed albatrosses (BF) and Laysan albatrosses (LA) in the Hawaii longline fishery if various mitigation measures are used in alternative management areas.**

		Percent Reduction in Total Incidental Catch				
Mitigation Measure		Option 1 Area (Above 25°N.)	Option 2 Area (Above 23°N.)	Option 3 Area (EEZ around the Hawaiian	Option 4 Area (EEZ around the Hawaiian	Option 5 Area (EEZ around the Hawaiian
Discharge offal strategically	BF	77	79	47	45	43
	LA	86	87	65	62	61
	All	81	83	55	53	51
Night setting	BF	78	81	48	46	44
	LA	33	34	25	24	24
	All	58	59	38	36	35
Blue-dyed bait	BF	88	90	54	52	49
	LA	85	86	65	62	61
	All	86	88	58	56	54
Towed deterrent	BF	79	82	48	47	44
	LA	67	68	51	49	48
	All	74	76	50	48	46
Weighted branch lines	BF	86	88	51	50	48
	LA	86	87	63	62	61
	All	86	88	56	56	54
Line-setting machine with weighted branch lines	BF	90	93	53	53	51
	LA	92	93	67	66	65
	All	91	93	59	59	57

Source: McNamara *et al.* (1999); Boggs in review; NMFS, SWFSC Honolulu Laboratory.



#### **10.1.4.1.3 Analysis of impacts of alternative management measures**

##### **10.1.4.1.3.1 No action**

Under the no action alternative the incidental catch of seabirds in the Hawaii longline fishery is expected to continue at the same rate. The NMFS, SWFSC Honolulu Laboratory estimates that between 1994 and 1998, an average of 1,392 Laysan albatrosses and 1,831 black-footed albatrosses were killed in the Hawaii longline fishery each year. These average annual incidental catches represent about 0.6% and 0.06% of the estimated black-footed and Laysan albatross populations, respectively. Besides the direct mortality to juvenile or adult birds, fishing-related deaths may also have a negative influence on chick survival if one or both parent birds are killed.

In the NWHI there are 59,622 nesting pairs of black-footed albatrosses and 558,378 nesting pairs of Laysan albatrosses. Neither species is listed as endangered, but both are protected under the US Migratory Bird Treaty Act. The long term chronic mortality resulting from the fishery may have a deleterious effect on these bird populations, particularly the less abundant black-footed albatross.

Further, one to two short-tailed albatrosses are known to visit the NWHI each year, but no incidental catches of this species have been reported in the Hawaii longline fishery. A single female short-tailed albatross has visited Midway Atoll every year during the breeding season for the last ten years. It is unknown why this albatross continues to return to the NWHI or where it forages. The Pacific population of the short-tailed albatross is only about 1,100, and this species is listed as endangered in most of the US under the US Endangered Species Act. Short-tailed albatrosses have been killed by the longline fleet in Alaska, and it is possible that interactions could occur with Hawaii-based vessels.

**10.1.4.1.3.2 Alternative 2 (preferred alternative):** For all vessels registered for use under a Hawaii longline limited access permit operating with longline gear, vessels captains must: 1) select and employ two or more of the mitigation measures in Table 8.1 when fishing above 25° N.; 2) follow proper handling techniques to increase the likelihood that birds brought onboard alive are released in a manner that ensures their long-term survival; and 3) annually complete a protected species educational workshop conducted by NMFS.

The preferred management area is above 25° N. (Option 1). If only one measure is used in the prescribed manner above 25° N., it is estimated that this alternative would reduce the incidental catch of seabirds in the Hawaii longline fishery by 58% to 91%, depending on which measure is selected (Table 10.6). As noted above, the reduction in the incidental catch of seabirds that would result from combining two or more measures is uncertain, but it is likely to lead to a further decrease in seabird catch.

This alternative would have a positive impact by allowing fishermen to experiment with different measures and select the most appropriate and practical measures for their vessel size, fishing operations and sea conditions. In addition, if fishermen switch frequently among mitigation measures the likelihood that seabirds will become habituated to measures is decreased.

The impact on seabird populations of applying mitigation measures in a certain geographic management area ultimately depends on the extent to which fishermen use the measures in a consistent and conscientious manner. By encouraging fishermen to experiment with different measures and share the results of these experiments with other fishermen this alternative is expected to promote an interest in implementing mitigation measures and lead to greater compliance. Requiring all vessel captains to annually attend a protected species educational workshop and follow handling techniques that maximize the probability of a hooked bird's survival will also lead to greater compliance and reduce seabird catch by increasing the information available to vessel operators on the extent of the problem and measures that can be taken to resolve it.

The US Coast Guard (USCG) has expressed concern that fishermen will select those mitigation measures that are the most difficult to monitor and enforce. Dockside inspections could determine whether fishing vessels are carrying the necessary gear to employ towed deterrents, strategic offal discharge or blue-dyed bait. However, because the USCG prefers not to board vessels while they are engaged in fishing operations, it would be difficult to determine whether these mitigation measures are being used by fishermen as specified in the regulations. Monitoring the employment of these measures would require the use of aerial surveillance and/or at-sea observation with binoculars and telephoto cameras. However, the Council maintains that the positive effects of allowing fishermen to vary their measures according to their vessel operations and at-sea conditions outweigh this enforcement concern.

To the extent that the difficulty of enforcing regulations leads to non-compliance, it may be problematic for the NMFS to compare data from NMFS observer reports and the NMFS Western Pacific Daily Longline Fishing Log to estimate reductions in the annual incidental catch of seabirds in the Hawaii longline fishery. In order to extrapolate the number of fleet-wide reductions in seabird catch from average observed interactions, it must be assumed that the same level of compliance occurs when an observer is absent as when an observer is present. This assumption will not be feasible if the difficulty of enforcement with these regulations leads to a high level of non-compliance. It will be possible to determine whether fishermen select those

mitigation measures which are the most difficult to enforce by checking fishermen's logbook records. The Council has recommended that NMFS modify its Hawaii longline fishery daily logbook form to require fishermen to indicate the mitigation measures used during a particular set or haul (Section 10.7). The Council views the reduction of the incidental catch of seabirds to be a dynamic issue, the resolution of which will require on-going monitoring and review.

**10.1.4.1.3.3    Alternative 3: Same as Alternative 2 except that the Council selects for all vessels the two or more mitigation measures to be employed**

Under this alternative the Council may select those mitigation measures which are the most effective in reducing the incidental catch of seabirds. In addition, the Council may select those mitigation measures which are the most easily monitored and enforced such as night setting, line-setting machines and the use of weighted branch lines. Night setting can be enforced by means of the vessel monitoring system (VMS) currently required on Hawaii-based longline vessels. Measures requiring the use of weighted branch lines and line setting machines can be effectively monitored through dockside inspections, as it is unlikely that fishermen would equip their vessels with this gear and not use it at sea. However, the Council believes that the positive effects of allowing fishermen to vary their measures according to their vessel operations and at-sea conditions, subject to continual monitoring and review of the effectiveness of this action, is preferable to specifying a combination of measures to be used by fishermen under all circumstances.

**10.1.4.1.3.4    Alternative 4: Fishing with longline gear is prohibited within the EEZ around the Hawaiian Islands above 23° N.**

If the EEZ around the Hawaiian Islands above 23° N. was closed to longline fishing, it is estimated that the incidental catch of seabirds would be reduced by about 62%. However, it is uncertain if an area closure would maintain the same level of mitigation over time. Seabirds may eventually learn that they can intercept fishing vessels by foraging outside the area closure. Many seabirds already forage far north of the EEZ around the Hawaiian Islands. The Council rejected this alternative because of its relatively low level of effectiveness in reducing the incidental catch of seabirds.

This alternative would facilitate enforcement, as compliance can be monitored with the existing vessel monitoring system.

**10.1.4.2            Impacts on sea turtles and marine mammals**

It is unlikely that any of the alternative management measures considered would have a significant negative impact on the species of sea turtles that occur in the Western Pacific region. The results of a study by Fontaine *et al.* (1985) suggest that the use of blue-dyed bait by Hawaii-

based longline vessels may reduce the incidental take of turtles. The researchers reported that the Atlantic Kemp's Ridley may have a preference for certain colors of food. Under experimental conditions turtles were given the choice of red-, yellow-, blue- and green-dyed food items. The test animals invariably chose the red-dyed food. Although it is possible that the turtles were reacting to a chemical stimulus created by the food coloring dye, Fontaine *et al.* (1985) concluded that it is more likely that the turtles' food preferences were based on visual factors. If turtles are less attracted to blue colored bait, some mitigation of turtle catch may already be taking place in the Hawaii longline fishery occurring in waters south of Hawaii. The vessels fishing in these waters bait their hooks with "sanma" (saury mackerel *Cololabis saira*) which are naturally colored blue.

The deployment of towed deterrents by longline vessels is unlikely to have any effect on turtles. Furthermore, there is no evidence that the frequency of turtle interactions with longline gear is related to the time of day (Kleiber 1998). Therefore, a possible increase in the number of night sets being made as a result of fishermen choosing night setting as a mitigation measure should not have an impact on turtle populations.

A recent analysis of NMFS observer records collected from 1994 to 1998 indicates that there may be an inverse relationship between the depth of a longline and the sea turtle take rate (P. Kleiber, pers. comm.). The turtle take rate of hooks attached close to the float is about twice that of hooks farther away from the float because the latter hooks hang at a greater depth. This finding suggests that the use of a line-shooter with weighted branch lines may reduce turtle interactions by decreasing the time that baited hooks are near the surface and accessible to feeding turtles.

The diet of adult loggerheads typically consists of benthic invertebrates from hard bottom habitats and pelagic crustaceans, molluscs and jellyfish (NMFS-USFWS 1998a). Leatherbacks feed primarily on jellyfish and tunicates (NMFS-USFWS 1998b). Consequently, the discharge of offal is unlikely to have an impact on sea turtles.

It is unlikely that any of the alternative management measures considered would have a significant negative impact on the Hawaiian monk seal, whales or other marine mammals that occur in the Western Pacific region. Interactions between marine mammals and the Hawaii longline fishery are rare. The use of line-setting machines and weighted branch lines, discharge of offal and night setting are all current practices in the Hawaii longline. The likelihood of towed deterrents causing injury to marine mammals is small. The use of blue-dyed bait is not expected to adversely impact marine mammals, as toothed whales and dolphins are already adept at removing bait from hooks without being snagged (C. Boggs, pers. comm.).

#### **10.1.4.3 Impacts on targeted finfish and related stocks**

To the extent that mitigation measures that reduce the incidental catch of seabirds also reduce bait loss caused by seabird predation, catch of targeted species, namely tuna and swordfish, would be expected to increase. In addition, Garcia and Associates report that dyeing

bait blue may result in an increase in the catch rate of tuna and swordfish (McNamara *et al.* 1999). However, the Hawaii-based longline fleet exploits only small fractions of fish stocks that are capable of extensive movement and are also harvested by foreign fleets and other types of domestic vessels operating in various EEZs and the high seas. Any increases in fish catch attributable to reduced bait loss or use of blue-dyed bait will not jeopardize the productive capability of the target resources species or result in cumulative adverse impacts that could have a substantial effect on the target resources species.

#### **10.1.4.4 Impacts on habitat**

None of the alternatives are expected to have a significant effect on the essential fish habitat or habitat areas of particular concern identified in the Council's management plans for pelagic fish, bottomfish, crustacean or precious coral fisheries.

#### **10.1.5 Conclusions and determination**

- a. The proposed action will not jeopardize the productive capability of the target resources species or any related stocks that may be affected by the action.
- b. The proposed action will not cause damage to ocean or coastal habitat.
- c. The proposed action will not have an adverse impact on public health or safety.
- d. The proposed action will not have an adverse affect on endangered or threatened species or any marine mammal population.
- e. The proposed action will not result in cumulative adverse impacts that could have a substantial effect on the target resources species or any related stocks that may be affected by the action.
- f. The proposed action will not have any effect upon flood plains or wetlands, nor upon any trails and rivers listed, or eligible for listing, on the National Trails and Nationwide Inventory of Rivers.

Based on the information contained in the environmental assessment, and other sections of this document, I have determined that the proposed alternative would not significantly affect the quality of the human environment, and therefore, preparation of an environmental impact statement is not required under the National Environmental Policy Act or its implementing regulations. Therefore, a finding of no significant impact is appropriate.

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Penelope Dalton  
NOAA Assistant Administrator for Fisheries

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Date

## **10.2 Executive Order 12866**

Executive Order 12866 requires that long term national net costs and benefits of significant regulatory actions be assessed through the preparation of Regulatory Impact Reviews (Appendix 2). In summary, it was found that Alternative 1 (no action) would fail to provide any additional protection to seabirds, while Alternative 2 (preferred alternative) will provide a positive net benefit to the nation through the cost-effective protection of seabirds. The recommended management area (all waters above 25° N.) provides protection to the greatest number of seabirds per unit of affected fishing effort, and the preferred alternative (fishermen must employ at least two of six tested mitigation measures in the management area, as well as attend annual protected species workshops and release all birds in a manner to maximize their survival) will minimize impacts on fishery landings subject to providing significant protection to seabirds. Alternative 3 (similar to alternative 2 except that the decision as to which mitigation measures must be used would be made by the Council) would provide similar levels of protection to seabirds. However, it could have significantly higher economic impacts on vessel operators. Alternative 4 (no longline fishing within Hawaii's EEZ above 23° N.) would provide a lower level of seabird protection, at a higher cost to vessel operators.

## **10.3 Regulatory Flexibility Act**

The Regulatory Flexibility Act, 5 U.S.C. 601 *et seq.* (RFA) requires government agencies to assess the impact of regulatory actions on small businesses and other small organizations. An Initial Regulatory Flexibility Analyses is presented in full in Appendix 2 of this document. In summary, it was found that Alternative 1 (no action) would not result in any additional costs, or changes in ex-vessel revenues due to changes in catch rates. However, it would fail to achieve the conservation objective. Alternative 2 (preferred alternative) would minimize economic impacts on vessel operators by allowing them to select which mitigation measures to use given their vessel operations and at sea conditions. Under this alternative, it is likely that those vessels which already set at night (primarily swordfish targeting vessels) would adopt this as one of their mitigation measures, while those vessels that already use line setting machines (primarily tuna targeting vessels) would employ this as one of their mitigation measures. In this manner, the negative economic impacts of any particular mitigation measure to the operator of any particular fishing vessel could be avoided and impacts on vessel operations and catch rates minimized. The impacts of Alternative 3 would vary depending on which two specific mitigation measures the Council required. Night setting would have uneven revenue impacts depending on vessel target while the other mitigation measures have unpredictable revenue impacts due to a lack of data. Direct costs for the range of mitigation measures considered vary from zero (night setting) to \$4,800 per year for the purchase and maintenance of towed deterrents. The economic impact of Alternative 4 would at maximum be the ex-vessel revenue forgone resulting from the prohibition on longline fishing in the closed area, this is estimated to average \$6.4 million annually (1994-1998). It is likely that some of this lost revenue would be made up by a displacement of longline effort to other areas, however the result of such changes is difficult to predict or quantify.

#### 10.4 Coastal Zone Management Act

The CZMA requires a determination that a recommended management measure has no effect on the land or water uses or natural resources of the coast zone, or is consistent to the maximum extent practicable with an affected state's approved coastal zone management program. A copy of this document has been submitted to the appropriate state government agency in Hawaii for review and concurrence with a determination made by the Council that the recommended measure is consistent, to the maximum extent practicable, with the state's coastal zone management program.

#### 10.5 Endangered Species Act

Species listed as endangered or threatened under the Endangered Species Act (ESA) (Public Law 93-205; 87 Stat. 884) that have been observed in the area where Hawaii-based longline vessels operate are as follows:

##### Species listed as endangered

Short-tailed albatross (*Phoebastria albatrus*) - except in the States of Hawaii, Oregon, Washington and California

Hawaiian monk seal (*Monachus schauinslandi*)

Pacific olive ridley turtle (*Lepidochelys olivacea*)

Leatherback turtle (*Dermochelys coriacea*)

Hawksbill turtle (*Eretmochelys imbricata*)

Green turtle (*Chelonia mydas*) - Florida and Pacific coast of Mexico breeding populations only

Humpback whale (*Megaptera novaeangliae*)

Sperm whale (*Physeter macrocephalus*)

Blue whale (*Balaenoptera musculus*)

Fin whale (*B. Physalus*)

Sei whale (*B. Borealis*)

##### Species listed as threatened

Loggerhead turtle (*Caretta caretta*)

Asian stocks of Pacific olive ridley and green turtles

The only listed or candidate species of seabirds is the short-tailed albatross. The world breeding population of the short-tailed albatross is estimated to be about 1,100 birds (NMFS 1999) and the only two breeding colonies for the species are located on Torishima and Minami-Kojima Islands in the western Pacific. Short-tailed albatrosses are known to visit the NWHI, but there are no reports of a successful breeding. There are also no observed reports of a short-tailed

albatross interacting with a Hawaii-based longline vessel. In 1997, one short-tailed albatross was seen flying near the stern of the NOAA vessel *Townsend Cromwell* during longline gear haulback research operations 593-nautical miles north of the island of Hawaii at 30° 28' N., 153° 37' W.

Currently, the short-tailed albatross is listed as an endangered species under the ESA throughout its range except in certain states (50 CFR 117.11). The incomplete protection in the US is a consequence of the former practice of the USFWS of preparing a "native" list versus a "foreign" list under the Endangered Species Conservation Act of 1969 (Public Law 91-135; 83 Stat. 275). When the ESA was enacted in 1973 it supplanted the Endangered Species Conservation Act of 1969, and the "native" and "foreign" lists were combined to create one list of endangered and threatened species. However, notice of the action was not given to the governors of the affected states (Alaska, California, Hawaii, Oregon and Washington) as required by the 1973 Act. In 1980, the USFWS published a proposed rule (45 FR 49844) to list the short-tailed albatross as endangered in the US, but the rule was never finalized. The USFWS recently published a second proposed rule to list the short-tailed albatross as endangered in the US (63 FR 58694; November 2, 1998), but this rule has also not been finalized. In Alaska the short-tailed albatross is listed as endangered under a state statute (Article 4. Sec.16.20.19), but it is not listed as an endangered species under the statutes of Hawaii, Oregon, Washington or California.

A biological consultation under Section 7 of the ESA was initiated by NMFS in 1999 to determine the effects of the Hawaii longline fishery on the short-tailed albatross. The biological consultation is expected to be completed in December 1999. A biological assessment concluded that the current chance of an interaction between a Hawaii-based longline vessel and a short-tailed albatross is extremely low, and it would be reduced further if mitigation measures were employed by longline vessels (NMFS 1999). The preferred management measure in this document is expected to reduce the possibility of a Hawaii-based longline vessel interacting with a short-tailed albatross.

The Hawaiian monk seal is a tropical seal which was once widespread in the Hawaiian Islands. Today, between 1,200 and 1,450 seals are found mainly in the NWHI from Nihoa Island to Kure Atoll (Johanos and Ragen 1997). In 1976, the species was designated as depleted under the Marine Mammal Protection Act following a 50% decline in beach counts from the late 1950s to mid 1970s. The Hawaiian monk seal has also been listed as an endangered species under the ESA. In the late 1980s, the shoreline to a depth of 20 fathoms (37 m) around breeding areas in the NWHI and Maro Reef was designated as critical habitat for monk seals.

Evidence of interactions between monk seals and the Hawaii longline fishery began to accumulate in 1990, and included three hooked seals and 13 unusual wounds thought to have resulted from interactions. In 1991, NMFS prohibited longline fishing within a Protected Species Zone which extends 50 nautical miles around the NWHI and includes the corridors between islands. Subsequent to the establishment of the Protected Species Zone there have been no reports of interactions between monk seals and the Hawaii longline fishery. The preferred



management measure in this document is not expected to have a significant effect on monk seals, as the Protected Species Zone will remain closed to longline fishing.

The populations of several species of sea turtles have declined in the Pacific as the result of nesting habitat loss and excessive and widespread harvesting for commercial and subsistence purposes (Eckert 1993). Leatherbacks and loggerheads are the species of principal concern with regard to incidental take in Pacific pelagic longline fisheries. These fisheries are conducted mainly by Japan, Taiwan, Korea and the US. There are only two populations of loggerhead turtles in the Pacific, one originating in Australia where serious declines are occurring, and the other in southern Japan (Eckert 1993). Leatherbacks inhabiting the Pacific mainly originate from nesting beaches in Mexico and Costa Rica where significant declines have been documented; from Indonesia where their status is uncertain but possibly stable; and from Malaysia where the nesting colony is nearly extinct despite 30 years of conservation measures (Eckert 1993).

It is estimated that in 1998 the Hawaii longline fishery interacted with 174 leatherbacks and 363 loggerheads. Both of these species are mainly taken by longline vessels fishing north of the Hawaiian Islands where the incidental catch of seabirds is the highest (Kleiber 1998a; Kleiber 1998b). A NMFS biological opinion determined that the Hawaii longline fishery was not likely to adversely affect sea turtle populations (NMFS 1998b; NOAA 1998a). However, NMFS is required to continue monitoring the incidental takes and mortality of sea turtles and seek ways to reduce them. Data for monitoring take levels and factors that affect takes are collected through a NMFS observer program operated by the Southwest Region and mandatory longline logbooks submitted to NMFS by longline vessel captains.

The preferred management measure in this document is not expected to have a significant negative effect on any of the species of sea turtles that occur in the Western Pacific region. The results of a study by Fontaine *et al.* (1985) suggest that the use of blue-dyed bait by Hawaii-based longline vessels may reduce the incidental take of turtles. The researchers reported that the Atlantic Kemp's Ridley may have a preference for certain colors of food. Under experimental conditions turtles were given the choice of red-, yellow-, blue- and green-dyed food items. The test animals invariably chose the red-dyed food. Although it is possible that the turtles were reacting to a chemical stimulus created by the food coloring dye, Fontaine *et al.* (1985) concluded that it is more likely that the turtles' food preferences were based on visual factors. If turtles are less attracted to blue colored bait, some mitigation of turtle catch may already be taking place in the Hawaii longline fishery occurring in waters south of Hawaii. The vessels fishing in these waters bait their hooks with "sanma" (saury mackerel *Cololabis saira*) which are naturally colored blue.

The deployment of towed deterrents by longline vessels is unlikely to have any effect on turtles. Furthermore, there is no evidence that the frequency of turtle interactions with longline gear is related to the time of day (Kleiber 1998). Therefore, a possible increase in the number of night sets being made as a result of fishermen choosing night setting as a mitigation measure should not have an impact on turtle populations.

A recent analysis of NMFS observer records collected from 1994 to 1998 indicates that there may be an inverse relationship between the depth of a longline and the sea turtle take rate (P. Kleiber, pers. comm.). The turtle take rate of hooks attached close to the float is about twice that of hooks farther away from the float because the latter hooks hang at a greater depth. This finding suggests that the use of a line-shooter with weighted branch lines may reduce turtle interactions by decreasing the time that baited hooks are near the surface and accessible to feeding turtles.

The diet of adult loggerheads typically consists of benthic invertebrates from hard bottom habitats and pelagic crustaceans, molluscs and jellyfish (NMFS-USFWS 1998a). Leatherbacks feed primarily on jellyfish and tunicates (NMFS-USFWS 1998b). Consequently, the discharge of offal is unlikely to have an impact on sea turtles.

Interactions between any species of cetaceans and the Hawaii longline fishery are rare. Between 1994 and 1998, NMFS observers recorded two entanglements involving a humpback whale and sperm whale. False killer whales occasionally strip the bait from longline hooks. To avoid this type of interaction Hawaii-based longline vessels that encounter false killer whales delay setting their lines until a sufficient distance between the vessel and the whale school has been achieved. It is unlikely that the preferred management measure in this document would have an effect on the endangered species of whales that occur in the Western Pacific region. The use of line-setting machines and weighted branch lines, discharge of offal and night setting are all current practices in the Hawaii longline fishery. The likelihood of towed deterrents causing injury to whales is small. The use of blue-dyed bait is not expected to adversely impact marine mammals, as toothed whales and dolphins are already adept at removing bait from hooks without being snagged (C. Boggs, pers. comm.).

## 10.6 Marine Mammal Protection Act

All fisheries in the waters around Hawaii, including the longline fishery, are classified as Category III under Section 118 of the Marine Mammal Protection Act of 1972 (62 FR 28657, May 27, 1997). Marine mammals not listed as endangered or threatened under the Endangered Species Act that have been observed in the area where Hawaii-based longline vessels operate are as follows:

Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)  
Rough-toothed dolphin (*Steno bredanensis*)  
Risso's dolphin (*Grampus griseus*)  
Bottlenose dolphin (*Tursiops truncatus*)  
Pantropical spotted dolphin (*Stenella attenuata*)  
Spinner dolphin (*Stenella longirostris*)  
Striped dolphin (*Stenella coeruleoalba*)  
Melon-headed whale (*Peponocephala electra*)  
Pygmy killer whale (*Feresa attenuata*)  
False killer whale (*Pseudorca crassidens*)

Killer whale (*Orcinus orca*)  
Pilot whale, short-finned (*Globicephala melas*)  
Blainville's beaked whale (*Mesoplodon densirostris*)  
Cuvier's beaked whale (*Ziphius cavirostris*)  
Pygmy sperm whale (*Kogia breviceps*)  
Dwarf sperm whale (*Kogia simus*)  
Bryde's whale (*Balaenoptera edeni*)

As noted in Section 10.5, it is unlikely that the preferred management measure in this document would have an impact on any species of marine mammals that occur in the Western Pacific region. Interactions between marine mammals and the Hawaii longline fishery are rare. The use of line-setting machines and weighted branch lines, discharge of offal and night setting are all current practices in the Hawaii longline fishery. The likelihood of towed deterrents causing injury to marine mammals is small. The use of blue-dyed bait is not expected to adversely impact marine mammals, as toothed whales and dolphins are already adept at removing bait from hooks without being snagged (C. Boggs, pers. comm.).

#### **10.7 Paperwork Reduction Act**

The operator of a fishing vessel that participates in the Hawaii-based longline fishery under the FMP is required to maintain and complete daily catch log reports.

The fisherman must record the date of set, vessel name, permit number, target species, bait used, length of mainline set, number of hooks and floats set, number of light sticks used, wind speed and direction, wave height, sea surface temperature, set begin time and position, end of set time and position, date of haul, begin haul time and position, end of haul time and position, pelagic species caught, number of shark species kept whole (not finned), number of shark species finned, number of shark species not kept and released, number of protected species caught and released (or lost) alive and not injured, number of protected species caught and released injured, number of protected species caught dead, name of vessel captain or vessel operator, and date when the logsheet was completed.

The log form used for the Hawaii longline fishery information collections is approved under OMB No. 0648-0214, Southwest Region Logbook Family of Forms.

The Council has recommended that NMFS should modify its Hawaii longline fishery daily logbook form to require the indication of seabird mitigation measures used while fishing (Table 8.1). The log form will be revised to allow fishermen to make a check in the appropriate labeled box. The total added annual burden resulting from the proposed collection of information is estimated to be less than 4 hours.

#### **10.8 Other Applicable Laws**

The Migratory Bird Treat Act (MBTA) of 1918 (16 U.S.C. 703-712; Ch. 128, July 13,

1918) implemented the 1916 Convention between the US and Great Britain (for Canada) for the protection of migratory birds. Both the black-footed and Laysan albatrosses are listed as migratory birds under the MBTA. The US is now Party to five international treaties that deal with the conservation and management of migratory birds: 1) the 1916 "Convention for the Protection of Migratory Birds" between the US and the United Kingdom (on behalf of Canada); 2) the 1936 "Convention for the Protection of Migratory Birds and Game Mammals" between the US and the United Mexican States; 3) the 1972 "Convention for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment" between the US and Japan; 4) the 1976 "Convention Concerning Conservation of Migratory Birds and their Environment" between the US and the Union of Soviet Socialist Republics; and, 5) the 1940 "Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere" in which the US and 18 other western Hemisphere nations are party.

Further, the Secretary of Commerce has given guidance to the Fishery Management Councils to note the existence of the MBTA and directs the Councils to "consider the impact of conservation and management measures on living marine resources other than fish" (i.e. marine mammals and birds) (50 FR 600.354e). However, under the current interpretation of the MBTA, the authority of the act is limited to the boundary of the "territorial land," which extends from the land to 3-12 miles offshore. Because of a Council action in 1991, Hawaii-based longline vessels are currently prohibited from operating within 50 nm of the NWHI. As the incidental catches of black-footed and Laysan albatrosses occur outside the US territorial land, these incidental catches also occur outside the jurisdiction of the MBTA.

## **10.9 Traditional Indigenous Fishing Practices**

The Magnuson-Stevens Act requires the Western Pacific Council to take into account traditional fishing practices in preparing any FMP or amendment. The recommended measures are not expected to have an impact on traditional indigenous fishing practices.

## **11.0 Appendix I: Specifications for Selected Mitigation Measures**

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### **11.1 Preparation of blue-dyed bait**

Bait can be dyed blue by soaking it in a mixture of triphenylethane dye and sea water. Triphenylethane dye is a non-toxic, odorless, blue powder. Because the dye powder is finely-grained and easily blown about by the wind, fishermen are encouraged to wear safety goggles and gloves during mixing in order to prevent staining. For convenience fishermen may want to prepare a concentrated dye solution by dissolving between 4-6 tablespoons of dye in one quart of fresh water prior to departing from port. At sea, this concentrated dye solution can then be mixed with approximately 15 gallons of sea water in a large container. Thawed or partially thawed bait placed in a mesh basket must be submerged in the dye solution and allowed to soak. If the baits are entirely thawed before dyeing, the dyeing process can be completed in 15 to 20 minutes. Before the dyed bait is used the color must be tested against a color quality control card issued by NMFS. Fishermen must throw the baited hooks outside the white water of the propeller wash.

### **11.2 Design and deployment of towed deterrents**

#### **11.2.1 Tori line**

The tori line must comply with the Tori Line Construction Protocols described in Appendix C of *Final Report: Hawaii Longline Seabird Mortality Mitigation Project* prepared by McNamara *et al.* (1999). These protocols have been established by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR 1993). The tori line must be positioned directly above the area where the baited hooks are being deployed. This position can be best achieved by securing the tori line to a sturdy fiberglass pole (tori pole) inserted in a swiveling steel base mounted near the stern of the vessel. Prior to deployment of the tori line, fishermen must determine the wind direction relative to the vessel's desired setting course. Immediately after the first radio buoy is released overboard, the tori line must be trailed from behind the vessel. No baited hooks are to be set until after the tori line is fully deployed. The tori pole must be positioned so that the aerial portion of the tori line covers the area where baited hooks enter the water while ensuring that the terminal end does not cross the longline or become entangled in suspender floats. Fishermen must throw the baited hooks outside the propeller wash and under the protection of the aerial streamers. The captain and crew must continually monitor the position of the tori line and make adjustments for course changes such that the aerial streamers effectively cover the area that baited hooks enter the water.

#### **11.2.2 Towed buoy system**

The design of the towed buoy system is similar to that of a tori line except a buoy is attached to the terminal end of the towed line and plastic strapping is used as streamers. The strips of plastic strapping must be woven through the towing line at 1 meter intervals. A second buoy can be added to the towing line to increase the distance that the aerial portion of the line remains aloft behind the vessel and to provide an additional splashing visible deterrent closer to

the vessel. The towed buoy system must be deployed in the same manner as a tori line.

### **11.3 Procedure for release of live birds**

All fishing vessels must have on board bolt cutters, pliers and a knife to remove fishing gear from entangled or hooked seabirds. When a seabird is hooked or entangled, the vessel must be stopped to reduce the tension on the line and the bird carefully lifted on board the vessel with a long-handled scoop net. It is recommended that fishermen work in pairs to remove line or hooks from the seabird, with one person holding the beak together and the other removing the entanglement or hook.

Hooks can be easily removed from wings, legs or bill tips by first cutting the line as close to the hook as possible and then remove the hook tip using the bolt cutters. The hook or entangled line should be carefully removed piece by piece until the line or hook is completely removed from the bird. Fishermen are encouraged to envision a hook in their own hand, leg or lip and remove the hook from the seabird in the same way they would remove a hook from themselves.

A hook which has been swallowed by a seabird is more difficult to remove, and the bird may not survive long unless the hook is carefully removed. It is important that a hook never be extracted backwards, as it will cause considerable damage to the seabird. To remove an ingested hook, one fisherman must hold the seabird's bill closed and straddle the bird so that the wings are held close to the body by the fisherman's legs. Next, the fisherman must gently open the bird's bill. The second fisherman must then reach down the bird's throat to grasp the hook while using his other hand to feel along the outside of the neck to determine the embedded hook position. The hook must be gently moved until it bulges under the skin of the bird's neck. At this point, a small cut, only large enough to expose the hook, can be made. The hook must be pushed out point first through the knife cut. Using the bolt cutters, the hook tip should be removed before the hook is removed. Fishermen are instructed not to attempt to save the hook.

After removing entangled line or the hook from a seabird, the bird must be left to recover for a short period before being released. There may be instances when an ingested hook is in the stomach and cannot be removed. In these instances, the line must be cut as close as possible to the hook and the bird released.

## 12.0 Appendix II

### Draft Regulatory Impact Review/Initial Regulatory Flexibility Analysis for Proposed Framework Adjustment to the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region Regarding Measures to Reduce the Incidental Catch of Seabirds in the Hawaii Longline Fishery.

#### INTRODUCTION

Executive Order 12866 requires that long term national costs and benefits of significant regulatory actions be assessed through the preparation of Regulatory Impact Reviews. In addition, the Regulatory Flexibility Act, 5 U.S.C. 601 et seq. (RFA) requires government agencies to assess the impact of their regulatory actions on small businesses and other small organizations via the preparation of Regulatory Flexibility Analyses. This document contains initial results of these analyses for the following proposed action.

#### PROBLEM STATEMENT AND NEED FOR ACTION

Many of the Hawaii based pelagic longline fishing vessels inadvertently hook and kill black-footed albatrosses (*Phoebastria nigripes*) and Laysan albatrosses (*Phoebastria immutabilis*) that nest in the Northwestern Hawaiian Islands (NWHI). The birds follow the longline vessels and dive on the baited longline hooks when the gear is being set, become hooked or entangled and drown. Estimates of the number of birds killed by the longline fleet are derived from data collected by National Marine Fisheries Service (NMFS) observers deployed on longline boats (principally to monitor fishing interactions with sea turtles). Some uncertainty surrounds the actual fleet-wide number of birds killed due to the low observer coverage (4 - 5% of the fleet) and the relatively uncommon and episodic nature of fatal interactions. However, it is estimated that as many as 1,828 Laysan albatrosses and 1,994 black-footed albatrosses are killed by longline gear each year. Black-footed albatrosses are less abundant than Laysan albatrosses at the NWHI, with about 58,416 nesting pairs, versus 558,378 nesting pairs of Laysan albatrosses. Neither albatross species is listed as endangered, but both are protected under the U.S. Migratory Bird Treaty Act (16 U.S.C. 703-711). The long term chronic mortality resulting from the fishery may have a deleterious effect on these bird populations, particularly the less abundant black-footed albatross. Further, a few short-tailed albatrosses (*Phoebastria albatrus*) also visit the NWHI each year, but no incidental catches of this species have been reported in the Hawaii longline fishery. The Pacific population of this species is only about 1,100, and it is listed as an endangered species in most of the US under the US Endangered Species Act. Seven short-tailed albatrosses have been killed by the Alaska bottom longline fleet and it is possible that interactions could occur with Hawaii permitted vessels. The Commission for the Conservation of Antarctic Marine Living Resources, of which the U.S. is a member, has adopted mitigation measures to reduce the incidental catch of seabirds in commercial fisheries in the Southern Ocean (Antartica). In addition, the U.S. has participated over the past two years in an international initiative developed from the United Nations Food and Agriculture Organization Committee on Fisheries (FAO-COFI) to reduce the incidental catch of seabirds in longline

fisheries worldwide. The FAO-COFI initiative is referred to as the International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA-SEABIRDS), and complements other FAO-COFI International Plans of Action for managing shark fisheries and reducing fishing capacity. The IPOA-SEABIRDS calls for concerned countries with longline fisheries to conduct an assessment to determine if a problem exists with respect to incidental catch of seabirds. If a problem exists, countries should develop a national plan containing the following elements: 1) mitigation methods of proven efficiency and cost-effectiveness; 2) research and development plans to improve and develop mitigation measures and evaluate their effectiveness; 3) education, training and publicity programs to improve the understanding of the problem resulting from the incidental catch of seabirds and the use of mitigation measures; and 4) data collection programs to determine the incidental catch of seabirds in longline fisheries and the effectiveness of mitigation measures.

#### **MANAGEMENT OBJECTIVE**

To reduce the incidental take and mortality of seabirds by the Hawaii limited entry permitted domestic longline fleet.

#### **MANAGEMENT ALTERNATIVES**

The Council considered four alternative management measures. These range from a No Action Alternative (Alternative 1), to a prohibition on longline fishing within Hawaii's EEZ above 23° N (Alternative 4). Alternatives 2 and 3 both require that vessel operators utilize two or more mitigation measures when longline fishing above 25° N. - the major difference between these two alternatives is that one allows the fishermen to select which measures they will utilize while the other leaves this decision to the Council.

Alternative 1 (No Action): no regulatory changes are made.

Alternative 2 (Preferred Alternative): For all vessels registered for use under a Hawaii longline limited access permit, vessel captains must: 1) select and employ two or more of the mitigation measures listed below when fishing above 25° N.; 2) handle and release hooked or entangled birds in a manner that maximizes the probability of their survival; and 3) annually complete a protected species educational workshop conducted by the National Marine Fisheries Service.

Alternative 3: For all vessels registered for use under a Hawaii longline limited access permit, vessel captains must: 1) employ two mitigation measures listed below (decision as to which specific measures are required would be made by the Council) when fishing above 25° N.; 2) handle and release hooked or entangled birds in a manner that maximizes the probability of their survival; and 3) annually complete a protected species educational workshop conducted by the National Marine Fisheries Service.

Alternative 4: Fishing with longline gear is prohibited within the EEZ around the Hawaiian islands above 23° N.



Description of mitigation measures:

**A. Discharge offal strategically:** While gear is being set or hauled, fish, fish parts or bait must be discharged on the opposite side of the vessel to where the longline is being set or hauled. If a swordfish is landed, the liver must be removed and the head must be severed from the trunk, the bill removed and the head cut in half vertically. The heads and livers must be periodically thrown overboard on the opposite side of the vessel to where the longline is being set or hauled. Because the supply of offal may be low when fish catch rates are low or tuna are the target species, this mitigation measure requires the preparation and storage of offal for use during the longline set, especially when catches are low. The intent of this measure is to divert seabirds from baited hooks to other food sources.

**B. Night setting:** The longline set must begin at least one hour after sunset and the set must be completed at least one hour before sunrise, using only the minimum vessel's lights necessary for safety. The purpose of setting fishing gear during hours of darkness is to reduce the visibility of baited hooks at the water's surface. Also, some species of seabirds are least active during this time.

**C. Blue-dyed and thawed bait:** An adequate quantity of blue dye that conforms to Council/NMFS standards must be maintained on board, and only bait dyed a color that conforms to Council/NMFS standards may be used. All bait must be completely thawed before the longline is set. The objective of dyeing bait blue is to reduce the attractiveness to seabirds of baited hooks at the water's surface. In addition, completely thawed bait tends to sink faster than frozen bait, thereby reducing the time that baited hooks are accessible to seabirds.

**D. Towed deterrent:** A line with suspended streamers (tori line) or a buoy that conforms to Council/NMFS standards must be deployed according to Council/NMFS standards when the longline is being set and hauled. These devices scare seabirds away from baited hooks at the water's surface, as well as provide a physical barrier that reduces the ability of seabirds to approach the hooks.

**E. Weighted branch lines:** Weights equal to or greater than 45 grams must be attached to branch lines within one meter of each baited hook. The purpose of attaching weights to branch lines is to increase the sink rate of baited hooks, thereby reducing the availability of baited hooks to seabirds.

**F. Line-setting machine with weighted branch lines:** The longline must be set with a line-setting machine (line shooter) so that the main line is set faster than the vessel's speed. In addition, weights equal to or greater than 45 grams must be attached to branch lines within one meter of each baited hook. The purpose of this measure is to remove line tension during the set, thereby increasing the mainline sink rate and reducing the time that baited hooks are at the surface and accessible to seabirds.

Economic impacts of mitigation measures on vessel operators:

Under Alternative 1 (No Action), there would be no requirement for vessel operators to use mitigation measures.

Alternative 2 (Preferred Alternative) and Alternative 3 both require the use of mitigation measures which could result in impacts to ex-vessel revenues due to changes in catch rates as well as direct costs due to the purchase and maintenance of mitigation devices. Table 12.1 presents a summary of the average revenue impacts (both per set, and annually) and annual direct costs (both variable and fixed) per vessel estimated for each of the proposed mitigation measures when applied to longline fishing operations above 25° N.. Effort levels are based on the long term average (1994-1998) of fleet wide operations, based on NMFS logbook data. With the exception of weighted branch lines, the percentage of 1998 sets which would be affected by each measure is based on 1998 observer data concerning the percent of sets not currently utilizing each measure. Lacking vessel specific data, it was assumed that the percentage of vessels affected would be equal to the percent of sets affected. Because data on the use of weighted branch lines did not differentiate whether the weight was placed within the required one meter of the hook, the percentages of sets not currently using weighted branch lines was assumed to be equal to those not currently using line setting machines, which are commonly employed in conjunction with correctly weighted branch lines. Catch rates with and without each measure were recorded by NMFS observers (1994-1998), and are specific to the set target. Details of this analysis are presented in Tables 12.2 - 12.5. In some cases, there were insufficient or no observer data concerning the catch per set effects of a given measure, or vessel target. In those cases, available data concerning fleet effort are presented in Table 12.1, along with any direct costs or qualitative information available. A complete lack of data is indicated by a question mark, and parentheses are used to indicate negative values where appropriate. Cost figures are based on a combination of sources, including the National Marine Fisheries Service, Garcia and Associates, and local fishing supply dealers.

Alternative 4 does not require the use of mitigation measures but rather prohibits longline fishing within Hawaii's EEZ above 23° N.

Table 12.1. Economic effects of mitigation measures applied to all vessels fishing above 25°N.

Target:	All	Swordfish	Mixed	Tuna
1994-1998 average number of sets	3,681	1,674	1,721	286
1994-1998 average number of vessels	38	41	45	29
1994-1998 average number of sets/vessel	97	41	38	10
<b>STRATEGIC OFFAL DISCHARGE</b>				
Percent of 1998 sets and vessels affected	100%	100%	100%	100%
Revenue change per affected vessel	low	low	low	low
Annual fixed cost per affected vessel	\$ 400	\$ 400	\$ 400	\$ 400
<b>NIGHT SETTING</b>				
Percent of 1998 sets and vessels affected	92%	97%	82%	97%
Revenue change per affected set	(\$121)	\$ 335	(\$598)	\$ 74
Annual revenue change per affected vessel	(\$11,737)	\$ 13,735	(\$22,724)	\$ 740
<b>BLUE DYED AND THAWED BAIT</b>				
Percent of 1998 sets and vessels affected	100%	100%	100%	100%
Revenue change per affected vessel	low	low	low	low
Variable cost per affected set	\$ 12	\$ 12	\$ 12	\$ 12
Annual variable cost per affected vessel	\$ 1,164	\$ 492	\$ 456	\$ 120
<b>TOWED DETERRENT</b>				
Percent of 1998 sets and vessels affected	100%	100%	100%	100%
Revenue change per affected vessel	low	low	low	low
Annual fixed cost per affected vessel	\$ 4,800	\$ 4,800	\$ 4,800	\$4,800
<b>WEIGHTED BRANCH LINES</b>				
Percent of 1998 sets and vessels affected	71%	100%	100%	13%
Revenue change per affected set	?	?	?	?
Annual revenue change per affected vessel	?	?	?	?
Annual fixed cost per affected vessel	\$ 1,200	\$ 1,200	\$ 1,200	\$1,200
<b>LINE SETTING MACHINE</b>				
Percent of 1998 sets and vessels affected	71%	100%	100%	13%
Revenue change per affected set	?	?	?	\$ 432
Annual revenue change per affected vessel	?	?	?	\$4,320
Annual fixed cost per affected vessel	\$ 1,500	\$ 1,500	\$ 1,500	\$1,500

Economic impacts of management alternatives on vessel operators:

Alternative 1 (No Action) would not result in any additional costs, or changes in ex-vessel revenues due to changes in catch rates, however it would also fail to achieve the conservation objective.

Alternative 2 (Preferred Alternative) would minimize economic impacts on vessel operators by allowing them to select which mitigation measures to use given their vessel operations and at sea conditions. Under this alternative, it is likely that those vessels which already set at night (primarily swordfish targeting vessels) would adopt this as one of their mitigation measures, while those vessels that already use line setting machines (primarily tuna targeting vessels) would employ this as one of their mitigation measures. In this manner, negative economic impacts of any particular mitigation measure to the operator of any particular fishing vessel could be avoided and impacts on vessel operations and catch rates minimized.

The impacts of Alternative 3 would vary depending on which two specific mitigation measures the Council required. As Table 12.1 illustrates, night setting would have uneven revenue impacts depending on vessel target while the other mitigation measures have unpredictable revenue impacts due to a lack of data. Direct costs for the range of mitigation measures considered vary from zero (night setting) to \$4,800 per year for the purchase and maintenance of towed deterrents.

The economic impact of Alternative 4 would at maximum be the ex-vessel revenue forgone resulting from the prohibition on longline fishing in the closed area, this is estimated to average \$6.4 million annually (1994-1998). It is likely that some of this lost revenue would be made up by a displacement of longline effort to other areas, however the result of such changes is difficult to predict or quantify.

Description of small businesses to which the rule will apply:

This rule could affect all 164 Hawaii limited entry permit holders (114 of which were active in 1998). The degree to which individual permit holders are actually affected will be a function of which alternative and mitigation measures are implemented, and how vessel operators respond to the new regulations. Lacking other information, this analysis assumes that vessels will continue to fish according to their long term (1994-1998) operating patterns, with the obvious exception of Alternative 4 which calls for a prohibition on longline fishing in certain areas.

This fleet's 1998 fleet landings totaled approximately 28 million pounds (245,600 pounds per vessel) and fleet ex-vessel revenue was \$46.7 million (\$410,000 per vessel). A total of 1,140 trips were made by the fleet in 1998, with an average of 10 trips per vessel. Eighty-four of these trips targeted swordfish, 296 had mixed targets, and 760 targeted tunas. Fleet landings consisted of 7,190,000 pounds (\$12 million) of swordfish, 11,190,000 pounds (\$28 million) of tunas, and 9,600,000 pounds (\$6.7 million) of other billfish (marlins), mahimahi, wahoo, moonfish and sharks. An average of 11 sets were made per trip in 1998, with a mean of 1,390 hooks set per vessel per fishing day.

Each vessel carries 4-5 crew members in addition to the captain, and the mean investment per vessel was estimated to be \$373,000 in 1993. The maximum permitted vessel length overall is 101 feet, and the average vessel is approximately 70 feet in length.

## **COST/BENEFIT ANALYSIS OF ALTERNATIVES**

Due to a lack of information concerning the specific long term effects of each alternative on fish or bird stocks, a detailed qualitative analysis of the costs and benefits of alternative management measures is not possible. Obviously, reductions in bird interactions are desirable and are the source of (non-market) economic benefits. The costs delineated in the Regulatory Flexibility Analysis represent both short-term and long-term impacts of the regulations. Reductions in the catch rates of various species of fish (due to either the direct effect of the mitigation measure or the requirement to fish in other locations) will have negative economic effects, as would increases in direct costs due to implementing the various mitigation measures. The biological effects of either reducing or increasing fish catches are expected to be neutral as the Hawaii longline fishery catch represents a small percentage of most pelagic stocks in the western Pacific.

Further analysis of this fishery is ongoing and may lead to simulation models capable of predicting the long term biological (and economic) effects of each alternative. At this time, such data is unavailable. From a theoretical perspective, it is clear that public policy favors a reduction in incidental interactions with sea birds and this implies a positive consumer surplus for reduced mortality. The willingness to pay (the standard economic estimate of non-market preferences) for reduced bird mortality discounted over time is expected to be substantial, while the equivalent discounting of immediate fixed costs is likely to be minimal. The discounted accumulated present and future effects of a change in catch rates is more problematic, but experience suggests that fishermen do adjust to regulations in a manner which tends to minimize their long-term impacts. As a result, it seems that the expected economic benefits (including non-market values) of these regulations are likely to exceed their private economic and public enforcement costs.

None of the alternatives is expected to have significant social impacts on fishery participants or Hawaii fishing communities in terms of employment, enjoyment of the fishery, social or cultural activity in the fishery, or other social factors.

Table 12.2 Revenue impacts per set of night setting for swordfish above 25°N.

1994-1998 Observer data				Change in Revenue
	CPUE With	CPUE Without	Change	
	<u>Catch per set</u>			
Blue shark	15.78	25.93	(10.15)	(\$228)
Swordfish	12.89	12.16	0.73	\$213
Bigeye	1.87	0.91	0.96	\$210
Yellowfin	0.64	0.53	0.11	\$21
Skipjack	0.05	0.05	0.00	\$0
Albacore	8.90	6.97	1.93	\$132
Mahimahi	0.94	0.68	0.27	\$7
Striped marlin	0.24	0.32	(0.08)	(\$6)
Blue marlin	0.04	0.09	(0.06)	(\$12)
Ono	0.09	0.13	(0.04)	(\$2)
Spearfish	0.05	0.03	0.02	\$0
Opah	0.02	0.02	0.00	\$0
Total revenue change per set:				\$335

Table 12.3 Revenue impacts per set of night setting for mixed targets above 25°N.

1994-1998 Observer data				Change in Revenue
	CPUE With	CPUE Without	Change	
	<u>Catch per set</u>			
Blue shark	20.48	16.76	3.72	\$84
Swordfish	8.79	10.62	(1.83)	(\$535)
Bigeye	1.92	2.81	(0.89)	(\$194)
Yellowfin	0.96	1.18	(0.23)	(\$43)
Skipjack	0.10	0.09	0.01	\$0
Albacore	4.91	2.81	2.10	\$144
Mahimahi	0.74	0.85	(0.11)	(\$3)
Striped marlin	0.48	0.94	(0.46)	(\$33)
Blue marlin	0.19	0.25	(0.06)	(\$13)
Ono	0.10	0.19	(0.09)	(\$5)
Spearfish	0.15	0.15	(0.01)	\$0
Opah	0.00	0.00	0.00	\$0
Total revenue change per set:				(\$598)

Table 12.4 Revenue impacts per set of night setting for tuna above 25°N.

1994-1998 Observer data				Change in Revenue
	CPUE With	CPUE Without	Change	
	<u>Catch per set</u>			
Blue shark	6.69	6.18	0.51	\$12
Swordfish	0.96	2.06	(1.10)	(\$322)
Bigeye	8.96	5.41	3.54	\$775
Yellowfin	1.07	2.41	(1.35)	(\$255)
Skipjack	0.18	0.04	0.13	\$2
Albacore	3.53	2.16	1.37	\$94
Mahimahi	0.69	0.71	(0.02)	\$0
Striped marlin	1.40	2.00	(0.60)	(\$43)
Blue marlin	0.93	1.78	(0.85)	(\$175)
Ono	0.18	0.40	(0.22)	(\$13)
Spearfish	0.40	0.37	0.03	\$1
Opah	0.42	0.44	(0.02)	(\$2)
Total revenue change per set:				\$74



Table 12.5 Revenue impacts per set of using a line setter for tuna above 25°N.

1994-1998 <u>Observer data</u>				Change in Revenue
	CPUE With	CPUE Without	Change	
	<u>Catch per set</u>			
Blue shark	5.52	7.36	(1.84)	(\$41)
Swordfish	0.35	3.06	(2.71)	(\$789)
Bigeye	8.70	4.70	4.00	\$875
Yellowfin	0.95	2.92	(1.97)	(\$375)
Skipjack	0.10	0.09	0.01	\$0
Albacore	4.25	0.96	3.29	\$225
Mahimahi	0.67	0.74	(0.07)	(\$2)
Striped marlin	2.33	1.11	1.22	\$88
Blue marlin	2.22	0.57	1.65	\$342
Ono	0.43	0.17	0.26	\$16
Spearfish	0.57	0.17	0.40	\$7
Opah	0.82	0.00	0.82	\$86
<b>Total revenue change per set:</b>				<b>\$432</b>

## **Appendix III:**

### **13.0 Future seabird mitigation research and monitoring seabirds at sea**

#### **13.1 Possible future seabird mitigation methods and research**

The array of seabird mitigation methods used at present in longline fisheries worldwide reflects current knowledge of the most effective methods available to reduce interactions. As such it should be clearly understood that technological innovation may make redundant certain methods currently recommended in this amendment and by organizations elsewhere such as the Food and Agricultural Organization of the United Nations (FAO).

##### **13.1.1 Underwater setting funnels, chutes and capsules**

One method that appears to offer a great deal of promise for the future are devices that ensure that birds are denied access to baited hooks by setting the line underwater. The simplest of these methods is a metal capsule which can be thrown into the water and retrieved. The baited hook from a branch line is placed in the capsule and the capsule thrown into the sea as the branch line is set. The rapid sink rate of the heavy metal capsule means that by the time the baited hook is released from therein, it is too far below the surface for birds to dive on and retrieve the bait. Trials with bait capsules have shown themselves to be effective on pelagic longline vessels in New Zealand (J. Molloy, Department of Conservation, pers. comm.)

A more expensive but effective method may be to have the branch line set through funnel attached to the boat, with the funnel end well below the water surface. This method removes the visual cue of a hand-thrown baited hook to seabirds and immediately places baited hooks outside the diving range of vulnerable albatross species (between 1.6 m and 3 m; C. Boggs, pers. comm.; Hedd *et al.* 1997; Prince *et al.* 1994). Experimental observations in New Zealand on pelagic longline vessels have shown that at 100 m behind the vessel, hooks set with an underwater setting chute will be about 3 m deeper in the water column than hooks set by hand (O'Toole and Molloy in review).

##### **13.1.2 Setting-curtains**

Another method which has shown some promise or is thought to be worthy of consideration to reduce seabird bycatch include setting-curtains. Setting curtains are large trains of material deployed behind the longline vessel over the sea surface. The longline mainline and branch lines are set under this curtain immediately behind the longline vessel giving the baited hook time to sink under the curtain at a depth beyond the range of the albatrosses.

##### **13.1.3 Hook modifications**

Hook modifications might be made such as magnesium caps that cover the barbed portion of the hook but which will dissolve rapidly in seawater leaving the hook with the point and barb

exposed in the bait. Also, hooks could be designed with a guard that only opens under pressure (C. Boggs, pers.comm.). Such modifications to hooks could minimize injury and mortality to seabirds which seized or swallowed the baited hooks. Boggs (in review) has shown that longline baits attached to branch lines using net pins (large safety pins) were easily regurgitated by birds, following seizure and swallowing.

#### 13.1.4 Negatively buoyant light sticks

Other approaches to reducing the incidental catch of seabirds in longline fisheries is to increase the sink rate of the baited hooks. Hawaii-based longline vessels targeting swordfish use buoyant luminescent light sticks that are attached to the branch lines with elastic bands approximately two to three meters from the baited hook. Often the elastic bands break and the light sticks are lost.

Once the light sticks are lost from the branch lines, they float on the ocean surface currents and are mistaken as food by albatrosses. Albatrosses have also been seen attempting to dive and swallow light sticks behind longline vessels as the longline is set (B. McNamara pers. comm.). Both the black-footed and Laysan albatrosses are known to ingest large volumes, as well as large pieces of plastic. Some of the plastic items found in the remains of black-footed and Laysan albatross chicks in the NWHI are light sticks and small line floats. There are several sources of the light sticks, including the US Navy, the US Coast Guard, foreign fishing fleets, and US fishing fleets. At this time, it is unknown how many of the light sticks ingested by the albatrosses originate from the Hawaii-based longline fishery. Plastic fed to the chicks can cause them to suffer from dehydration and starvation, can inflict mechanical injury to the lining of the gut wall, or can block the entrance of food into the intestine (Kenyon and Kridler 1969; Sievert and Sileo 1993). The toxic effects of the ingested plastic have also been well documented for both black-footed and Laysan albatrosses, with greater concentrations of PCBs (polychlorinated biphenyls) and DDE dichlorodiphenyldichloroethylene) found in the black-footed albatrosses (Auman *et al.* 1998).

A light stick manufacturer, Lindgren-Pitman, Inc., has just completed the tooling for a battery-driven luminescent light stick. This new light stick is negatively buoyant so it will sink if it is lost. Still, these battery-driven light sticks are not disposable and are rather expensive, so to reduce loss, the light sticks are designed to be attached to the branch lines with a durable snap. As the light stick is negatively buoyant, it should increase the sink rate of the baited hook, thereby reducing the amount of time the baited hooks stay at the surface and available to the birds.

#### 13.1.5 Hook sink rates

Currently, the hook sink rates for the different gear types in the Hawaii pelagic longline fishery are unknown. In theory, a "bird safe" hook sink rate could be determined for Hawaii longline vessels. Taking into account that albatrosses are surface feeders and rarely dive deeper than two meters, fishing gear configurations and vessel operations could be modified to achieve a

hook sink rate that would essentially remove the opportunity that an albatross could reach a baited hook as the longline is being set.

For example, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) has adopted mitigation measures to reduce the incidental catch of seabirds in commercial fisheries in the Southern Ocean and under these measures, longline vessels are not permitted to fish in the daylight unless they can prove that they can sink their baited hooks by at least 0.3 m/sec. Two New Zealand longline vessels fishing in Antarctic waters set their longline at about 5 knots and have configured their gear to sink at the minimum requirement of 0.3 m/sec. These vessels are required to carry two observers and temperature/depth recorders (TDRs) are used to ensure the vessel complies with the minimum sink rate. This is a new approach to solving the seabird bycatch problem and is still under investigation.

#### **13.1.6 Other possible methods**

Methods which might be considered but for which there is no compelling evidence of their efficacy include artificial baits or lures with reduced palatability, water cannons and acoustic deterrents to scare birds, and possible high-tech solutions such as the use of intense magnetic fields to disorientate seabirds. However, it is important to continually assess new mitigation methods, and modifications to existing methods, both to improve their efficacy and ease of use, and to cope with possible habituation by seabirds to particular methods.

### **13.2 Monitoring seabirds at sea**

#### **13.2.1 Fishery Data Collection**

The two major sources of information on albatross interactions with Hawaii-based longline vessels are the mandatory logbook and observer data collection programs administered by NMFS. The longline logbook program requires operators of longline vessels to complete and submit to NMFS a data form containing detailed catch and effort data on each set (50 CFR 660.14). Although the information is extensive, it does not compare to the completeness of the data collected by NMFS observers. Furthermore, preliminary comparisons between logbook and observer data indicate under-reporting of protected species interactions by vessel operators in the logbooks (Biological Assessment, NMFS, Southwest Region, December 1996).

The Observer Program administered by NMFS was implemented in February 1994 to collect data on protected species interactions (marine turtles have highest priority) which include: all sea turtles, especially greens, leatherbacks, and loggerheads; Hawaiian monk seals; selected whale and dolphin species; and seabirds, including the albatross species and the Brown Booby (*Sula leucogaster*). The Observer Program has achieved 4.7%, 5.5%, 4.9%, 3.5% coverage of all trips in the first four years since it was implemented (1994 to 1998). The selection of trips to observe is based on a sampling design by DiNardo (1993) to monitor sea turtle interactions. The Pacific Islands Area Office, Southwest Region NMFS, is attempting to increase observer coverage from five percent to at least ten percent.

Although data collection on protected species is the primary purpose of the Observer Program, the observers also collect catch data on the fishery and in total record five different sets of data: 1) incidental sea turtle take events; 2) fishing effort; 3) interactions with other protected species; 4) fishes kept and discarded, by species; and 5) life history information, including biological specimens in some instances.

In October 1997, NMFS observers deployed on Hawaii-based longline vessels began recording which mitigation measures, if any, were being used voluntarily by fishermen. Information from the observer program for 1998 showed that nearly all vessels used some measure, the most common being to avoid setting the line in the vessel wake. About 55% of the vessels thawed the bait before baiting hooks, 29% of the vessels set at night and 11% avoided discarding unused bait while setting the fishing line. Only two percent of the vessels used a towed deterrent or blue-dyed bait.

Once fishermen will be required to use seabird mitigation measures, NMFS observers will be trained to collect more detailed information about the frequency of use of the measures during a fishing trip and specific characteristics of the use of the measures. For instance, observers will note if a tori line was deployed in a manner to ensure its effectiveness, or whether the bait was sufficiently dyed and thawed before use. In addition, observers will record the number of birds around the vessel during fishing operations. Clearly, if no birds are near the vessel while a tori line is deployed, this would introduce a basis in the effectiveness of the measure.

### 13.2.2 Satellite telemetry studies

Collecting albatross foraging information at sea is complicated by the highly migratory nature of the birds, yet there is a need to determine the localities and significance of these feeding areas and to learn about the factors that govern the availability of food at these areas. Placing satellite tags on seabirds is one way to gather spatial and temporal information of albatrosses while at sea. Satellite telemetry studies of albatrosses would yield information on the patterns of flight, time spent in specific regions, and the distances traveled on a daily basis. Results from satellite tag studies could offer an explanation on how the albatrosses exploit oceanic resources.

Besides gaining valuable information of albatross foraging behaviors, satellite tags could also serve as a form of mitigation. For instance, satellite telemetry studies would yield more concise information regarding the spatial distribution and movement patterns of the endangered short-tailed albatrosses. If the short-tailed albatrosses visiting the NWHI were tracked on a daily basis, the foraging patterns and migratory routes of these birds in and out of Hawaiian waters would be more defined. A clearer picture of the potential for interactions between a short-tailed albatross and the Hawaii-based longline fishery could be learned if the daily tracks of these birds were compared to the positions of known fishing activities.

### 13.3.3 Bird-banding Data

For over the past 60 years the USFWS and several other private seabird researchers have been banding black-footed and Laysan albatrosses in the NWHI, and since April 1962, Japanese researchers have been banding short-tailed albatrosses. Analysis of bird-banding data collected from black-footed albatrosses encountered at sea shows that juvenile birds are caught on longlines more often than adult birds (Cousins in review; Cousins and Cooper in prep.). How this mortality affects the age structure and composition of the albatross populations is unknown; however, analysis of bird-banding capture and recapture records might yield information on the age structure and composition of the NWHI albatross populations.

As reported at the Black-footed Albatross Population Biology Workshop (Cousins and Cooper in prep.), it is possible that the analysis of three existing bird-banding data sets may likely produce accurate estimates of survival of fledged chicks to recruitment to the breeding population. The first is the cohort of 1,000 color-banded chicks fledged at Eastern Island, Midway Atoll, in 1957. The second data set is the cohort of 2,000 chicks banded on Sand Island and 90 chicks on Eastern Island, Midway Atoll in 1979. The third data set is a cohort of 2,090 chicks banded on Midway Atoll in 1995. From the first data set a survival of 273 birds to age five years equates to a mean annual survival of 0.771. The remaining two data sets require further analysis, although preliminary analysis shows that survival of chicks banded in 1979 and the 1990s was somewhat lower than for birds banded in the late 1950s.

Currently, the only information collected while banding birds is dictated by the bird-banding laboratory manual. While all of the information collected by the BBL is critical, and there is great consistency in its collection, other vital sources of information are often ignored and not collected. For instance, current BBL schedules or USFWS data collection methods do not allow for the reporting of mate pairing data. Undoubtedly, researchers and bird-banders have observed mated pairs while banding chicks; however, the BBL does not require this information, so this information is not collected. Periodically, an effort to collect mated pair information was undertaken by the USFWS and other researchers, but this data is rarely utilized as the researchers often lacked the banding history of the birds. This particular data source could be invaluable. For instance, if one of the mated pairs is taken in a fishery, what happens to the surviving mate? Will the surviving mate find another mate? Do chicks survive with only a one parent providing? These questions could be addressed if the band numbers of known mated pairs were to be collected and entered into a relational database. In addition, the band numbers of offspring could also be recorded and entered into a relational database.

Further, banding birds and then monitoring these banded birds could yield information on the post-hooking survival of longline caught albatrosses. USFWS report and unknown number of birds have returned to the colonies with hooks or entanglements. A medial doctor on Midway Atoll is sometimes called upon by refuge staff to remove a hook from a bird. Detailed records and banding records certainly would assist efforts to understand post-hooking survival rates and to determine if the incidence of ingested hooks was on the increase or decrease after implementation of seabird mitigation measures.

## 14.0 Appendix IV: Background Information

### 14.1 Description of seabirds occurring in the range of the Hawaii longline fishery

#### 14.1.1 Albatrosses (Order Procellariiformes, Family Diomedidae)

Three species of albatross breed and forage in the North Pacific: the Short-tailed albatross, the Black-footed albatross and the Laysan albatross. NMFS observer data show that fishery/seabird interactions occur between the Hawaii-based longline fishery and two species of albatross: the Black-footed albatross and the Laysan albatross. There have been no reports of interactions between the endangered Short-tailed albatross and the Hawaii-based longline fishery, but this situation could change in the future as the Short-tailed Albatross population is growing in size.

##### 14.1.1.1 Short-tailed albatross (*Phoebastria albatrus*)

The short-tailed albatross is the largest seabird in the North Pacific with a wingspan of more than 3 meters (9 ft) in length (Table 14.1). The short-tailed albatross bill is larger than the bills of Laysan and black-footed albatrosses and is characterized by a bright pink color with a light blue tip and defining black line extending around the base (Fig. 14.1). The plumage of a young fledgling (i.e., a chick that has successfully flown from the colony for the first time) is brown and at this stage, except for the bird's pink bill and feet, the seabird can be easily mistaken for a black-footed albatross. As the juvenile short-tailed albatross matures, the face and underbody become white and the seabird begins to resemble a Laysan albatross. In flight, however, the short-tailed albatross is distinguished from the Laysan albatross by a white back and by white patches on the wings. As the short-tailed albatross continues to mature, the white plumage on the crown and nape changes to a golden-yellow.

##### 14.1.1.2 Black-footed albatross (*Phoebastria nigripes*)

The black-footed albatross is characterized by dark bills, legs and feet at all stages of their development (Fig. 14.2). Comparatively, the black-footed albatross is slightly larger and heavier than the Laysan albatross (Table 14.1), but for the same-sex birds there is no significant difference between the two species (Harrison *et al.* 1983; Whittow, pers. comm.). Interestingly, the Japanese black-footed albatross is reported to be slightly smaller than their Hawaiian counterparts (H. Hasegawa, pers. comm.). The plumage coloration for both the immature and adult black-footed albatross is extremely similar; brown with a white band at the base of their bill and a white sweep defining their eyes. One of the distinguishing features between adult and juvenile (i.e., young-of-the-year) black-footed albatrosses are that the juveniles lack the white plumage at the base of their tail. The plumage of the immature birds can be, but is not always, slightly darker in coloration than the adult birds. Generally, as the juvenile black-footed albatrosses mature, they tend to become more gray or dusty in appearance (Miller 1940).

#### 14.1.1.3 Laysan albatross (*Phoebastria immutabilis*)

Laysan albatrosses are characterized by white plumage on their head, neck and chest, and sooty brown plumage on their upper wings, back and tail (Fig. 14.3). The Laysan albatross underwings have variable patches of dark and white plumage and are distinguished by dark leading edges and wing tips. Laysan albatrosses have fleshy-pink colored legs and webbed feet, and in flight the feet project beyond the tail. The Laysan albatross eye is defined with gray and black plumage that extends to a thin line behind the eye. There are no distinguishing characteristics between sexes or between adult and immature phases.

Table 14.1. Morphometric comparisons between short-tailed, black-footed and Laysan albatrosses.

	Short-tailed Albatross	Black-footed Albatross	Laysan Albatross
Length (cm)	~94	64 - 74	79 - 81
Wing Span (cm)	~213	193 - 216	195 - 203
Body Mass (kg)	~7.0	2.0 - 3.8	1.9 - 3.1
Bill Length (cm)	12 - 14	9.4 - 11.3	10 - 11

Source: Warham 1977; Harrison *et al.* 1983; Whittow 1993ab; Hasegawa and DeGange 1982.

#### 14.1.2 Boobies (Order Pelecaniformes, Family Sulidae)

Three species of boobies breed in the NWHI and forage in the North Pacific: the masked booby, the brown booby and the red-footed booby. Currently, the World Conservation Union classifies boobies as "not globally threatened." Like the albatrosses, the boobies are also long-lived and have a delayed maturity. Unlike the albatrosses, which are primarily surface feeders, the boobies are plunge divers and also tend to take flying fish (*Cypselurus* spp.) just above or at the surface of the water. To date, there have been no reports of lethal interactions between boobies and the Hawaii-based longline fishery, but boobies are reported to sit on vessel decks and watch the baited hooks as they are being set or hauled back. NMFS observers report boobies hovering over baited hooks and some birds may actually attempt a dive, however, no boobies have been reported hooked. Although the foraging behavior of boobies may differ from that of the albatrosses, such that they do not interact with longline fishing vessels or gear in the same manner, boobies are present during fishing operations and potential for fatal interactions does exist.

##### 14.1.2.1 Masked booby (*Sula dactylatra*)

Adult masked boobies, also called white boobies, blue-faced boobies or whistling boobies, are mostly white with dark plumage on their tail and tips of their wings (Figure 14.4). This booby is distinguished by a dark 'mask' around the eyes and bill. The 'mask' is actually the featherless blueish skin of the bird. There is some variation in the color of the bill and feet, such that the bill varies in color from a deep orange to a pink and the feet are a dark grey to olive green (Nelson 1978). During the breeding season, the male bill becomes a brighter yellow than the female's bill (Nelson 1978). Juvenile masked boobies differ from the adults in that they are



predominantly brown with a white underbelly, throat and neck.

#### **14.1.2.2 Brown booby (*Sula leucogaster*)**

The adult brown booby is recognizable by chocolate brown to dark plumage on the head, neck, upper surface of the wings and tail, with a sharp line across the upper breast defining the white plumage of the lower breast and abdomen (Figure 14.5). The undersurface of the wing has a distinctive white bar extending out from the white of the body toward the wing tip. In the Pacific, the head and neck plumage can vary with some birds being slightly darker and others, such as those in the Eastern Pacific, being pale grey to white (Nelson 1978). The color of the bill, face and feet also vary with region, sex and breeding condition (Nelson 1978). In general, the female bill is a light greenish-yellow with a white or greyish-green tip, whereas, the male bill is greenish-grey with a white tip. The feet vary in color from a pale green to a bluish-green. Juvenile brown boobies are similar to the adults except that the plumage is paler and on the undersurface is a pale, dirty grey in color.

#### **14.1.2.3 Red-footed booby (*Sula sula*)**

In flight, the adult red-footed booby, also known as the white-tailed or Webster's booby, resembles the masked booby (Figure 14.6), in that the plumage is mostly a brilliant white with black wing tips and a light yellow crown and nape. The diagnostic features for the species are a blue bill, reddish facial skin, and bright red legs and feet. In some regions, there are adult red-footed boobies with ashy-brown plumage, but these birds are rare in the NWHI (Harrison 1990). The juvenile characteristics differ greatly from the adult, such that the plumage is a pale brown, the bill is a dark brown, the facial skin is purple and the legs and feet are yellow. About eight months after hatching, the legs and feet will become redder (Nelson 1978). Overall, it takes about two or three years for the juveniles to mature to the adult form (Woodward 1972).

### **14.2 Breeding and at-sea distribution of protected seabirds**

#### **14.2.1 Short-tailed albatross**

The short-tailed albatross is known to breed only in the western North Pacific Ocean, south of the main islands of Japan. Although at one time there may have been more than ten breeding locations (Hasegawa 1979), today there are only two known active breeding colonies, Minami Tori Shima Island ("Torishima") (30° 29' N., 140° 19' E.) and Minami-Kojima Island (25° 56' N., 123° 42' E.). A few short-tailed albatrosses have been observed attempting to breed, although unsuccessful, at Midway Islands ("Midway") (28° 12' N., 177° 20' W.) in the Northwestern Hawaiian Islands (NWHI). Midway lies roughly 1,750 miles east and slightly to the north of Torishima.

Historically, the short-tailed albatross ranged along the coasts of the entire North Pacific Ocean from China, including the Japan Sea and the Okhotsk Sea (Sherburne 1993) to the west

Figure 14.1 On the left is a mature short-tailed albatross in flight (photograph by H. Hasegawa). On the right is an immature short-tailed albatross in flight (photograph by H. Hasegawa). Note how similar the immature short-tailed albatross resembles a black-footed albatross (Figure 14.2).

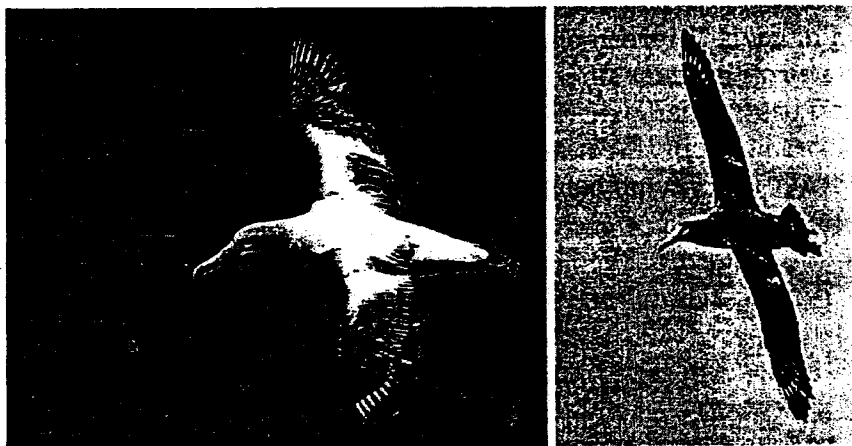


Figure 14.2 On the left is a mature black-footed albatross in flight [photographs by R. Pitman in Harrison (1996)]. On the right is a mature black-footed albatross at Midway Atoll. Note the black-footed albatross is wearing two bird-bands, one on each leg (photograph by K. Swift).

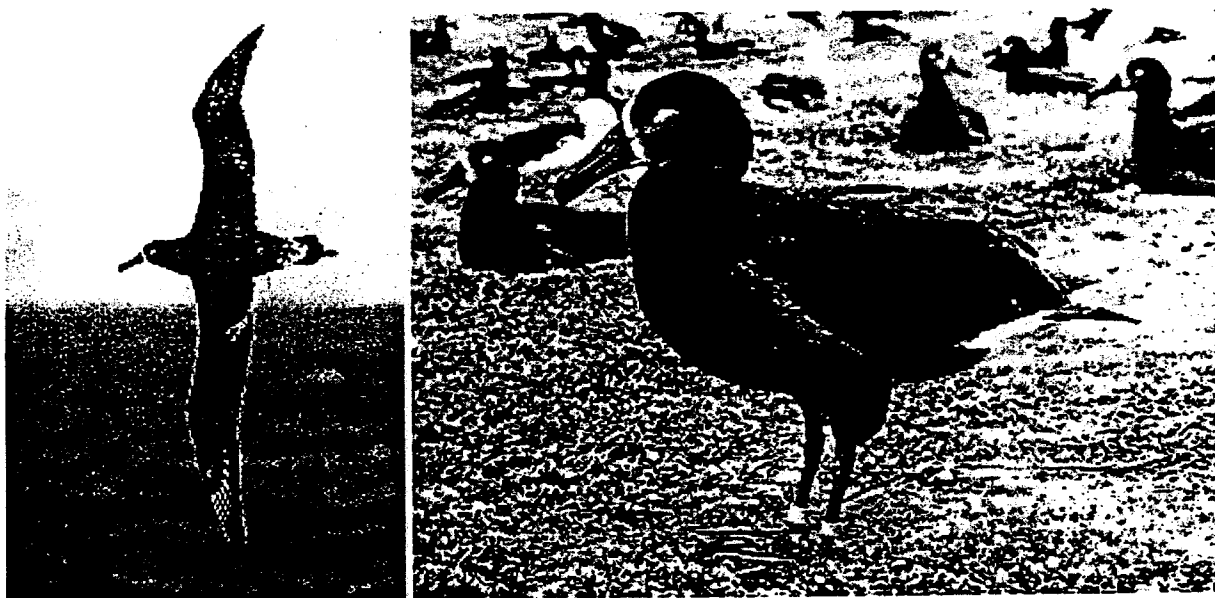


Figure 14.3 Laysan albatross in flight [photographs by R. Pitman in Harrison (1996)].

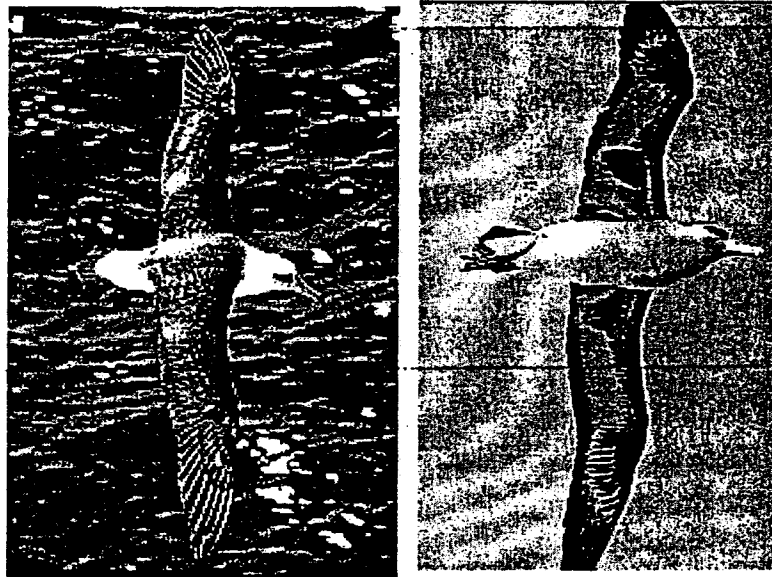


Figure 14.4. Breeding masked boobies with a newly hatched chick (Photograph by C. Harrison, 1990).

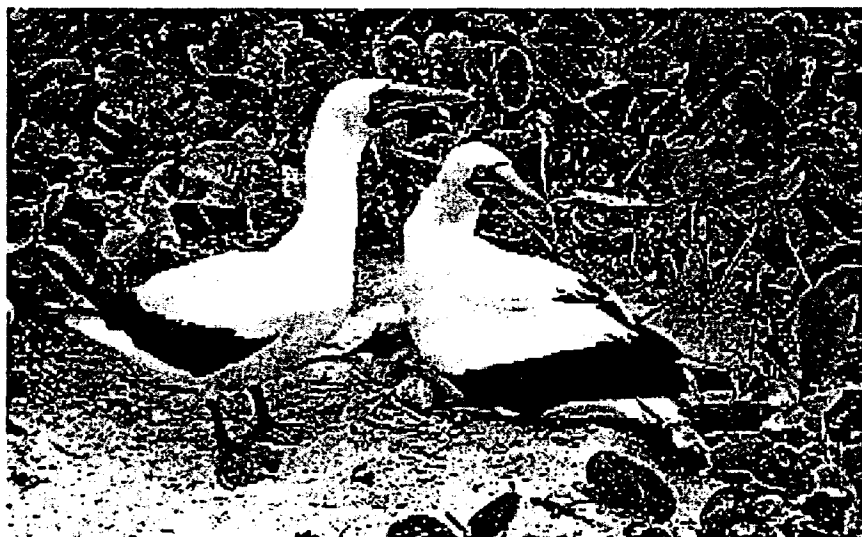
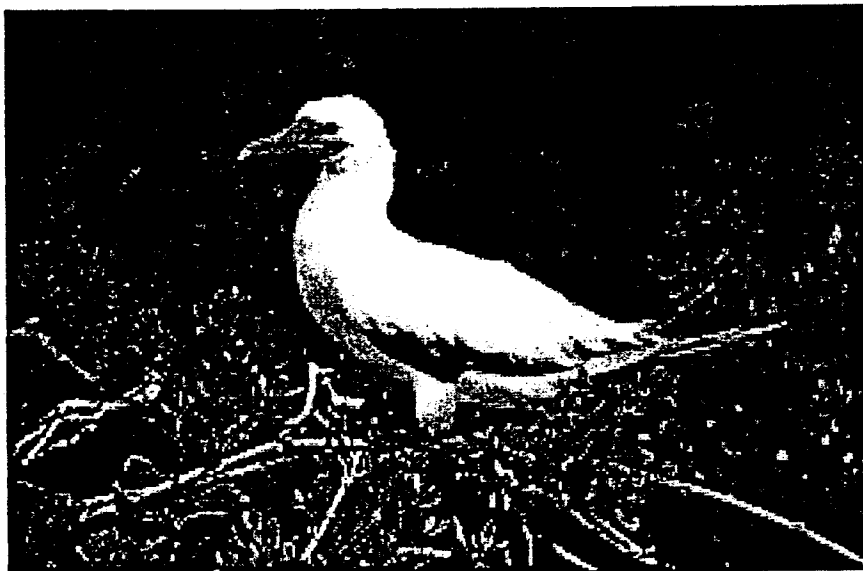


Figure 14.5 Mature brown boobies and a chick (photograph by C. Harrison, 1990).



Figure 14.6 Mature red-footed boobie (photograph by C. Harrison, 1990).



coast of North America. Prior to the harvesting of the short-tailed albatross at their breeding colonies, this albatross was considered common year-round off the western coast of North America (Robertson 1980). The short-tailed albatross ranges from approximately 66° N. to 10° N. latitude (King 1981) and are known to occur near St. Lawrence Island, north to the Bering Strait, south to the Barren Islands in Lower Cook Inlet and in the Gulf of Alaska (DeGange 1981). Other Bering Sea records include sightings around the Komandorskie Islands, Diomed Islands, and Norton Sound (AOU 1961). Only one sighting of a short-tailed albatross has been reported in the waters surrounding the NWHI (NMFS 1999).

#### **14.2.1 Black-footed and Laysan albatrosses**

The NWHI are the primary breeding colonies for the black-footed and Laysan albatross populations. The feather and egg trade in the early 1900s destroyed nesting colonies on the Japanese, Izu, Wake, Bonin and Marcus Islands, as well as colonies on Johnston and Taongi Atolls (Rice and Kenyon 1962; McDermond and Morgan 1993). However, a small population of approximately 1,106 - 1,206 black-footed albatrosses have recolonized the Japanese Islands of Torishima (Rice and Kenyon 1962; Hasegawa 1984; Ogi *et al.* 1994) and there have been recent observations of Black-footed albatrosses visiting Wake Island (Rauzon 1988, unpubl. observ.) and two mated pairs have been sighted over Minami Iwo Jima in 1982 (E. Flint, pers.comm.). Likewise, Laysan albatrosses have established colonies on Torishima Island (Kurata 1978), as well as Guadalupe Island (Pittman 1988) and off the west coast of Mexico (Howell and Webb 1989). Since 1998, there have been no reports of visitations by either black-footed or Laysan albatrosses to Johnston Atoll or to Marcus Island (E. Flint, pers. comm.).

Black-footed and Laysan albatrosses range throughout the North Pacific between 20° N. and 58° N. latitude. Knowledge of their distribution comes primarily from reports of encounters with banded birds, from scientific transects, and from observations. A few birds have been tracked over long distances by satellites (Anderson and Fernandez 1998). The black-footed albatross occurs regularly in large numbers off the west coast of Canada and the United States. The Laysan is common in the Gulf of Alaska, the Aleutian Islands and Bering Sea. In addition, more Laysan sightings are being reported on the California coast, perhaps due to the relatively new colony in Mexico. Both species occur off the East Coast of Japan. Whereas the great majority of pelagic encounters of Laysan albatross have come from west of the 180° meridian (Robbins and Rice 1974), those of the black-footed albatross, although strongly clustered, are more uniformly distributed across the North Pacific Ocean.

#### **14.2.2 Boobies**

Masked, brown and red-footed boobies range throughout the tropic and subtropical waters of the world's oceans. All three booby species breed throughout the NWHI and on or on rocky remnants offshore of the main Hawaiian Islands. Generally, the boobies that breed in the Hawaiian Archipelago are year round residents (Harrison 1990) and forage close to the breeding colonies. Relatively large red-footed boobies colonies (>500 breeding pairs; Harrison 1990) are located on Oahu, Kauai and Lehua Islands while only a few masked and brown boobies are

known to breed on Lehua and Moku Manu islands (Harrison 1990).

Adult masked and red-footed boobies tend to remain close to their breeding colonies while the younger and immature birds roam up to 150 km offshore (Nelson 1978). Masked boobies, in particular, tend to return to land to roost at night. Some red-footed boobies, as well as brown boobies, are known to range as far as Wake and Marshall islands, but the resident masked boobies tend to remain in the Hawaiian Archipelago (Harrison 1990).

### **14.3 Abundance and present condition of seabird populations**

#### **14.3.1 Short-tailed albatross**

Prior to the 1880s, the short-tailed albatross population was estimated to be in the millions and it was considered the most common albatross species ranging over the continental shelf of the United States (DeGange 1981). Between 1885 and 1903, an estimated five million short-tailed albatrosses were harvested from the Japanese breeding colonies for the feather, fertilizer, and egg trade, and by 1949 the species was thought to be extinct (Austin 1949). In 1950, ten short-tailed albatrosses were observed nesting on Torishima (Tickell 1973).

In an effort to protect the short-tailed albatross from feather hunters, Torishima was declared a "Kinryoku" (no hunting area) in 1933, but the regulation was not enforced (Yamashina in Austin 1949). In 1956 the Japanese government declared the short-tail albatross a protected species and declared Torishima a National Monument (Tickell 1975). In 1972 Japan further designated the short-tailed albatross a special bird for protection (King 1981). Currently, under the World Conservation Union (IUCN) criteria for identification of threatened species, the conservation status for the short-tail albatross is listed as vulnerable (Croxall and Gales 1998). The species is also listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES; July 1, 1975) which protects the endangered species by prohibiting its commercial import or export or the trade of its parts across international borders. Currently, the short-tailed albatross is listed as an endangered species throughout its range under the Endangered Species Act 1973 (ESA), except within the states of California, Hawaii, Oregon and Washington (50 CFR 117.11). In Alaska, the short-tailed albatross is listed as endangered under State statutes (Article 4. Sec.16.20.19). Although the USFWS published a second proposed rule to list the short-tailed albatross as endangered within the US (63 FR 58694; November 2, 1998), this has not been finalized as of yet and the short-tailed albatross is not listed as an endangered species in the State of Hawaii.

Today, the breeding population for the short-tailed albatross is estimated at approximately 243 breeding pairs: 213 pairs on Torishima (see Table 14.2) and 30 pairs on Minami-Kojima (H. Hasegawa, pers. comm.). It is projected that there will be 380 breeding pairs on Torishima by the year 2010 based on preliminary population analyses by H. Hasegawa (Toho University, Japan). Currently, short-tailed albatross have an annual survival rate of 96% and population growth rate of 6.7% (Hasegawa 1997). Because of the robust growth of the population at Torishima, and the fact that short-tailed albatrosses do not return to the colony until

three or four years of age, a large number of these birds are dispersed at sea. Furthermore, at least 25% of the reproducing adults also remain at sea during each breeding season (Cochrane and Starfield in prep.). As a consequence, the exact number of individuals in the population is difficult to assess and at this time is unknown; however, the current best estimate of the worldwide population of short-tailed albatrosses is at 1,100 individuals (H. Hasegawa, pers. comm.).

Table 14.2. Short-tailed albatross census counts at Torishima, Japan, for the last twenty years from 1977 to 1997. Values marked by an asterisk indicate there are uncertainties associated with the data (i.e., few observations). Note: sub-adults were not always differentiated from adults in some years.

Breeding Season	Breeding Pairs	Adults	Sub-adults	Eggs	Chicks	Chicks Fledged
1977 - 1978	--	73	12	40	12*	12
1978 - 1979	--	96	12	--	--	22
1979 - 1980	--	130	32	50	20	20*
1980 - 1981	--	130	--	54	--	32
1981 - 1982	--	140	--	63	--	21
1982 - 1983	--	150	--	67	--	34
1983 - 1984	--	160	--	65	--	32
1984 - 1985	--	172	--	73	--	51
1985 - 1986	--	165	--	76	--	47
1986 - 1987	--	146*	--	77	64*	53
1987 - 1988	--	171	--	84	58*	57
1988 - 1989	--	203*	--	89	--	51
1989 - 1990	--	223	--	94	--	50
1990 - 1991	115*	202	--	108	66	66
1991 - 1992	--	232	--	115	--	51
1992 - 1993	--	302	--	139	--	66
1993 - 1994	--	301	--	146	--	79
1994 - 1995	--	324	--	153	--	82
1995 - 1996	--	337	--	158	--	62
1996 - 1997	--	349	--	176	--	90

Source: Tickell (1975); Sanger (1972); Hasegawa (1977).

#### 14.3.2 Black-footed albatross

The current world population of breeding black-footed albatrosses is estimated at 300,000, with 61,866 pairs in 15 colonies (Table 14.3). Twelve of the colonies are located in the Northwestern Hawaiian Islands (NWHI) comprising the majority of the breeding population (59,622 breeding pairs). Eighty percent of the NWHI breeding pairs nest in three colonies that are routinely surveyed by the USFWS: Laysan Island, Midway Atoll and French Frigate Shoals. The largest black-footed albatross colony accounting for approximately 38% of world population is on Laysan Island. Midway Atoll has the second largest black-footed albatross colony with 33% of the world population. French Frigate Shoals only accounts for about 7% of the world population. Three black-footed albatross colonies are also located in the Western Pacific

(estimated 2,244 breeding pairs) accounting for 3.6% of the world population. On, Torishima, six black-footed albatross chicks were successfully reared in 1957 and since then the number of chicks reared has increased to 914 in 1998 (H. Hasegawa, unpubl. data). The black-footed albatross populations on Bonin and Senkaku Islands have also modestly increased (see Table 14.3).

Under the IUCN criteria for identification of threatened species, the conservation status for the black-footed albatross is currently listed as Vulnerable (Croxall and Gales, 1998). The Vulnerable status was given because the taxon "is not critically endangered or endangered but is facing a very high risk of extinction in the wild in the near future" (Croxall and Gales, 1988). To obtain the vulnerable conservation status, the black-footed albatross population must show declines of greater than 20% over 10 years or three generations.

Direct counts of active nests during the egg stage have been completed for Midway Atoll from 1991 to 1998, Laysan Island from 1997 to 1998, and French Frigate Shoals every year since 1979. Common to all three of these breeding sites is that the numbers of active nests tend to fluctuate from year-to-year. The most recent count for Midway Atoll in December 1998 yielded 20,510 nests for a decline from 1996 of 1,135 breeding pairs or 5.5%; however, over a period of eight years (1991-1998) the number of black-footed albatross pairs have increased by 3.7%. At French Frigate Shoals, between 1987 and 1988, there was a decrease (11.7%) in the number of active nests at French Frigate Shoals from 5,067 to 4,535. Between 1991 and 1998, however, the number of black-footed albatross breeding pairs at French Frigate Shoals has increased from 3,912 to 4,164 breeding pairs. Direct counts of active nests at Laysan Island also indicate that there was a 4.2% increase from 22,314 nests in 1997 to 23,297 nests in 1998.

In summary, declines greater than 20% have not been noted in the two largest colonies on Laysan Island and Midway Atoll over the last decade. Most colonies appear to be either fluctuating or increasing in the number of breeding pairs, although the increases are not especially large in size. Overall, it is estimated that between 1991 to 1998, the number of NWHI breeding pairs of black-footed albatrosses has increased by about 8%.

#### 14.3.3 Laysan albatross

It is estimated that before the feather hunters reached Marcus Island, the island had a population of one million Laysan albatrosses (Rice and Kenyon 1962). Feather hunters also raided Laysan albatross colonies in the NWHI taking at least 300,000 birds from Laysan Island in 1909 (Dill and Bryan 1912). The current world population of breeding Laysan albatrosses has moderately recovered to an estimated 2.4 million, with 558,415 breeding pairs in 15 colonies (Table 14.3). Twelve of the colonies are located in the NWHI comprising of the majority of the breeding population (558,378 breeding pairs). The largest Laysan albatross colony (69% of the world population) is on Midway Atoll. Laysan Island has the second largest colony (22% of the world population). A Laysan albatross colony located on Bonin Island is comprised of 14 breeding pairs while three other colonies (with a total of 23 breeding pairs) are located in the Eastern Pacific on Guadelupe (Dunlap 1988) and the San Benedicto Islands, and Isla Clarion,



Mexico (Howell and Webb 1992).

Laysan albatrosses are the most numerous of the North Pacific albatrosses and the majority of the population breeds in protected areas. Consequently, the IUCN assigned a "lower risk – least concern" criteria to the species (Croxall and Gales 1998). As Laysan albatrosses are present at the NWHI breeding colonies in large numbers, it is often difficult to obtain accurate counts of breeding pairs. As a result, annual standardized counts of breeding pairs have not been completed for the Laysan albatross population at its largest colony, Midway Atoll. Only two direct counts (i.e., a count of every bird seen during a complete survey of an island or a portion of an island) have been completed on Midway Atoll, one in 1991 (427,556 breeding pairs) and the second in 1996 (387,854 breeding pairs). The results from these counts suggest that the population has decreased by at least 10% in five years. Given that Midway Atoll is the largest colony for the species, concern should be raised by this finding. Estimates of breeding pairs generated by an extrapolation method on Laysan Island suggest that the colony has been fluctuating in numbers, with an overall 17% decrease in breeding pairs between 1991 to 1998. Tern Island shows an increase of 35% in the number of Laysan albatross breeding pairs during the same period, but this colony only represents a small fraction (<0.38%) of the world population. Overall, it is estimated that between 1991 to 1998, the number of NWHI breeding pairs of Laysan albatrosses has declined by about 10%.

Table 14.3. A summation of current best available figures for the number of breeding pairs of black-footed and Laysan albatross populations for each breeding site. A number sign (#) indicates that breeding is suspected but not confirmed. An asterisk (\*) indicates an extrapolation to total eggs from chicks counted later in the season assuming a 75% reproductive success.

Breeding site	Black-footed Albatross	Laysan Albatross
Kure Atoll 28° 25' N, 178° 10' W	1,653* (1997)	5,539* (1997)
Midway Atoll 28°12' N, 177° 20' W	20,510 (1998)	387,854 (1996)
Pearl and Hermes Reef 27° 55' N, 175° 45' W	6,949* (1998)	11,429* (1997)
Lisianski I. 26° 02' N, 174° 00' W	2,901* (1999)	26,500 (1982)
Laysan I. 25° 42' N, 171° 44' W	23,297 (1998)	124,113 (1998)
French Frigate Shoals 23° 45' N, 166° 15' W	4,164 (1998)	2,105 (1998)
Necker I. 23° 35' N, 164° 42' W	112* (1995)	500* (1995)
Nihoa I. 23° 06' N, 161° 58' W	31* (1994)	0 (1995)
Kauai I. 22° 14' N, 159° 24' W	0 (1995)	100 (1995)
Lehua I. 22° 01' N, 160° 06' W	#	Unknown
Niihau I. 21° 55' N, 160° 14' W	Unknown	175
Kaula I. 21° 40' N, 160° 32' W	5 (1993)	63
<b>Total for NWHI</b>	<b>59,622</b>	<b>558,378</b>
Senkaku Islands	25 (1991)	0
Bonin Is. (Chichijima)	1,000 (1993)	14
Izu Is. (Torishima)	1,219* (1998)	0
<b>Total for Japanese Islands</b>	<b>2,244</b>	<b>14</b>
Guadelupe Is.	0	10
Mexican Is.	0	13
<b>World Total</b>	<b>61,866</b>	<b>558,415</b>

Source: E. Flint, USFWS, and H. Hasegawa, unpubl. data.

#### 14.3.4 Boobies

The population size and composition for the three booby species is currently unknown. Currently, the IUCN classify the boobies as "not globally threatened." Although boobies breed throughout the Hawaiian Archipelago, apparently only three localities have been routinely monitored by the USFWS in Honolulu (Table 14.4). Harrison (1990) reported breeding pair numbers from surveys of booby colonies completed between 1981 and 1988. From the surveys completed in the 1980s, it was estimated that there were about 14,000 masked boobies, 1,500 brown boobies and 11,000 red-footed boobies (Harrison 1990).

Table 14.4. NWHI booby counts at Johnston Atoll, Midway Atoll and Tern Island, French Frigate Shoals, between 1979 and 1996.

	Johnston Atoll			Midway Atoll	Tern Island	
	Red-footed	Masked	Brown	Red-footed	Red-footed	Masked
1979	--	--	--	--	385	--
1980	--	--	--	--	441	--
1981	40	--	92	--	394	--
1982	--	--	80	--	341	--
1983	35	--	56	--	500	--
1984	40	--	150	--	605	--
1985	57	--	135	178	727	--
1986	86	--	123	--	691	--
1987	84	1	169	--	735	--
1988	102	3	200	282	932	--
1989	116	3	189	410	1,133	--
1990	119	9	217	427	888	--
1991	189	5	204	--	1,267	--
1992	230	11	287	555	1,348	18
1993	312	13	401	--	1,579	23
1994	309	14	369	--	1,040	29
1995	320	18	361	--	1,561	32
1996	--	--	--	563	2,194	35

Source: USFWS Refuges Office, Honolulu, Hawaii, unpubl. data.

#### 14.4 Probable future condition of seabird populations

##### 14.4.1 Potential fishery-induced impacts on seabird populations

While boobies are not known to interact with the Hawaii-based longline fishery, albatrosses have been reported to interact with fishing gear when they swallow baited hooks or entangle in the line. Generally, boobies tend to fish closer inshore than the albatrosses, with

brown boobies fishing closer inshore than the other two species (about 16 to 24 km from shore; Anderson 1954). Masked boobies rarely follow ships, whereas red-footed boobies range far from shore (up to 150 km; Nelson 1978), freely approach vessels and readily perch in rigging. Boobies fish almost entirely by day, with the exception of the red-footed booby which is more nocturnal than the other two booby species, and have evolved to plunge dive (up to 5 m; Nelson 1978) for their prey, using feet as flippers. Some booby species remain underwater for 25 - 40 seconds suggesting a pursuit by swimming (Gibson-Hill 1947). Boobies also specialize in the aerial pursuit of flying fish (*Cypselurus* spp.), catching their prey above or just at the surface of the water. Albatrosses, on the other hand, are strictly surface feeders making shallow dives for prey items or baited hooks. Behaviorally, albatrosses tend to follow vessels more so than boobies and eagerly scavenge offal or galley refuse. Given these differences in foraging behaviors between boobies and albatrosses and the lack of fishery interaction records for boobies, it appears that the albatrosses are the seabirds most at risk of being Hawaii longline fishing operations. Therefore, the remainder of the section will focus on longline fishery induced changes for black-footed and Laysan albatross populations.

Decreases in albatross populations in the last decade have been observed world-wide and are thought to be primarily due to increases in longline fishing effort (Gales 1998). Albatrosses are long-lived species, have delayed maturity and low reproductive output and consequently, any changes in the survival and breeding success of the species result in dramatic changes in the population demographics. Albatross populations are more sensitive to losses of adults from the population rather than juveniles because breeding adults caught and killed in longline fisheries result in the loss of the chick as two parents are needed to successfully fledge a chick. In addition, the surviving mate may lose up to three breeding seasons looking for a new mate. Thus, when adults are taken on longline fishing vessels, the population reproductive output is severely disrupted.

It is likely that the age structure composition of the albatross populations changes with fishing pressure because the young are more likely to be taken than the adults (Cousins and Cooper in prep.; Cousins in review). Decreases in juvenile survival are difficult to detect in albatross population demographics because of the species' delayed maturation. Juveniles are not yet old enough to breed and may not appear at the breeding sites to be counted for several years. Hence, the age structure composition and juvenile recruitment of the NWHI black-footed and Laysan albatross populations remain unknown.

Whether the noted fluctuating pattern of breeding pair numbers is indicative of birds being hooked and killed on longline fishing gear or is an indication that the albatross populations are being limited by food resources is unknown. Certainly, other fisheries targeting squid, the primary prey item for the albatrosses, must take food resources away from growing albatross populations, but how this affects the population growth is unknown.

Mitigation measures adopted by the Hawaii-based longline fishery would reduce the incidental mortality of albatrosses caught on longlines. In theory, there should be an immediate increase in fecundity due to a reduction in the number of widowed albatrosses searching for new

mates. With both parents supplying food to their chicks, there should be an increase in chick and fledgling survival. And, after three to five years of mitigative effort by the Hawaii longline fishermen, there should be a noted increase in juvenile recruitment into the breeding populations.

#### **14.4.2 Potential environment influences on seabird populations**

The region of greatest interactions between seabirds and the Hawaii longline fleet is a latitudinal band from 25° N. to 40° N., from the dateline to about 150° W. longitude (NMFS unpub. data). This region is often termed the North Pacific Transition zone and contains a broad, weak, eastward flowing surface current composed of a series of fronts situated between the Subtropical Gyre to the south and the Subarctic Gyre to the north (Roden 1980; Seki *et al.* in prep.). During the winter and spring, westerlies in the northern portion of the Transition Zone and trade winds to the south result in wind-driven transport of surface waters creating fronts as colder hence more dense northern water converges with warmer and lighter water from the south (Roden 1980). North of Hawaii, convergent fronts have been observed during winter to persist at about 28° N., 31° N., and 34° N. latitude (Niiler and Reynolds 1984; Roden 1980; Seki *et al.* in prep.). These fronts represent sharp boundaries in a variety of physical parameters including temperature, salinity, chlorophyll, and sea surface height (geostrophic flow) (Niiler and Reynolds 1984; Roden 1980; Seki *et al.* in prep.).

Biologically, these convergent fronts appear to represent zones of enhanced trophic transfer (Bakun 1996; Olson *et al.* 1994). The dense cooler phytoplankton-rich water sinks below the warmer water creating a convergence of phytoplankton (Roden 1980). Buoyant organisms such as jellyfish, as well as vertically swimming zooplankton, can maintain their vertical position in the weak down-welling, and aggregate in the front to graze on the down welled phytoplankton (Bakun 1996; Olson *et al.* 1994). The concentration of these organisms in turn attract the higher trophic level predators, and ultimately a complete pelagic food web is assembled (Olson *et al.* 1994) and available to foraging seabirds.

### **14.5 Description of fishing activities affecting the stock(s) comprising the management unit**

#### **14.5.1 Longline vessel characteristics and fleet composition**

A detailed summary of the history of the Hawaii longline fishery is available in Boggs and Ito (1993). Longline fishing in Hawaii had been conducted for many decades prior to the expansion of the fishery in the late 1980s. Hawaii longline vessels evolved from wooden pole-and-line tuna sampans, employing longlines made from rope and fishing mainly within 2 - 20 nm of the coast. By the 1930s the longline fishery was second only to the pole-and-line fishery in landed volume of fish, and accounted for most of the yellowfin (*Thunnus albacares*), bigeye (*Thunnus obesus*) and albacore (*Thunnus alalunga*) landed in Hawaii. The fishery peaked in the mid 1950s with landings exceeding 2000 t and then declined steadily through lack of investment in boats and gear until the late 1980s.

The revitalization of the longline fishery was due to the development of local markets and export markets for fresh tuna on the US mainland and in Japan. Participation in the longline fishery increased from 37 vessels in 1987 to 80 in 1989, and then increased again to 144 vessels in 1991 (Figure 14.7). Following the rapid expansion of the fishery between 1987 and 1991, entry to the longline fishery was halted through a moratorium on permit issuance in 1991, under an amendment to the Council's Pelagic Fisheries Management Plan (FMP). In 1994, a limited entry program was implemented for the Hawaii longline fishery through another amendment to the FMP. This amendment established a cap of 164 permits for the Hawaii longline fishery, and limited fishing capacity by restricting maximum vessel size to 94 ft.

Landings in the Hawaii longline fishery increased rapidly from 1987 onwards, and by 1991 had reached 9,000 t, of which 4,400 t was broadbill swordfish (*Xiphias gladius*). The new entrants in the longline fishery were mostly steel hulled vessels up to 33 m in length and their operators were former participants in the US east coast tuna and swordfish fisheries. These newer vessels in the fishery were also characterized by a greater reliance on sophisticated electronic gear for navigation, marking deployed longline gear and finding fish. The revitalized fleet also adopted more modern longline gear, using continuous nylon monofilament main lines stored on spools, with snap-on monofilament branch lines.

Monofilament longline gear is more flexible in configuration and can be used to target various depths more easily than traditional rope longlines. Both daytime and nighttime fishing are practiced using the same monofilament system. In targeting deep swimming bigeye tuna, 12-25 hooks are deployed between floats with lots of sag to reach as deep as 400 m. Only a few hooks are deployed between floats when targeting swordfish and the line is kept relatively taut so that it stays within the first 30-90 m of the water column. Night fishing employs luminescent light sticks that attract swordfish and bigeye tuna, or their prey. The longlines are baited with large imported squid (*Illex* spp).

Fishing for bigeye tuna requires a line-setting machine (i.e., line-shooter) to deploy sufficient line to achieve a sufficiently deep curve or sag in the longline. Many of the new entrants into the longline fishery did not invest in line throwers. These vessels fished shallow even when targeting tuna which led to concern about interactions between the longliners and small handline and troll vessels, as well as recreational fishermen and charter boat operators in the early 1990s. Over the same period, the range of the longline fishery expanded, with some vessels fishing up to 1,000 nm from Hawaii and over half of the longline sets made at distances greater than 50 nm away from the main Hawaiian Islands (MHI). Then in early 1991, longline fishing was prohibited within 50 nm of the Northwestern Hawaiian Islands to prevent interactions between endangered populations of Hawaiian monk seals (*Monachus schauinslandi*).

A further longline 50-75 nm exclusion zone was established in mid 1991 around the MHI through Amendment 5 of the FMP. The closure around the MHI was in response to the concern of small boat handline fishermen, charter boat operators and recreational fishermen who felt that the longline boats were depleting tuna stocks around the MHI. Enforcement of the two longline exclusion zones around the MHI and the NWHI is accomplished through the Councils mandatory

Vessel Monitoring System (VMS) policy, where longline boats must be equipped with a satellite transponder that provides "real-time" position updates and the track of the vessel movements.

#### 14.5.2 Effort levels

A summary of fishing effort in the Hawaii longline fishery is given in Figure 14.7 and Tables 14.5 and 14.6. Data in Sections 14.5.2 - 14.5.3 are drawn from Ito and Machado (1999). The number of fishing vessels operating in the Hawaii longline fishery rose from 50 in 1987 to a peak of 140 in 1991, followed by a period of decline and stabilization to between 100 and 110 vessels by the late 1990s. Records of fishing activity extend only from 1991, after log books catch records were required of the longline vessels through a Council regulation. Although the number of vessels active in the fishery has decreased, the overall fishing effort in number of hooks deployed has risen from 12.3 million in 1991 to 17.4 million hooks in 1998 (Figure 14.7 and Tables 14.5, 14.6).

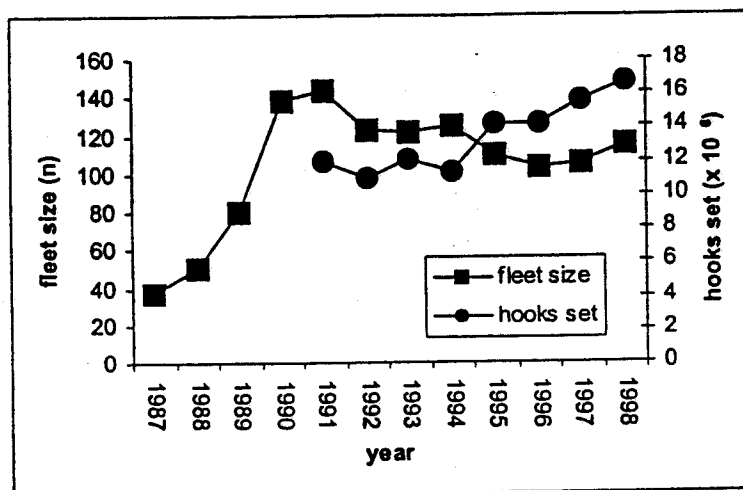


Figure 14.7. Summary of fishing effort in the Hawaii longline fishery.

The distribution of this fishing effort with respect to targeting has also changed since 1991 (Figure 14.8 and Table 14.5). The number of trips targeting principally tuna has risen steadily since 1991. Swordfish targeting trips declined by over 50% after 1994 but showed a slight increase between 1997 and 1998. Mixed-target trips declined precipitously between 1991 and 1994, with a modest increase between 1994 and 1998. The change in targeting is an important factor in the longline fishery, since it is swordfish targeting vessels that are likely to have the highest interactions with albatross. A major shift in targeting by the fleet to swordfish may lead to an increase in potentially fatal interactions with albatrosses.

Table 14.5. Summary of vessels, trips, and hooks by trip type by the Hawaii-based longline fishery 1991 to 1998.

Year	Number of Active Vessels	Number of Trips	Number of Hooks <sup>1</sup>
<b>Fleet</b>			
1991	141	1670	12.3
1992	123	1265	11.7
1993	122	1192	13.0
1994	125	1106	12.0
1995	110	1125	13.3
1996	103	1100	14.4
1997	105	1125	15.6
1998	114	1140	17.4
<b>Swordfish Trips</b>			
1991	98	291	2.4
1992	66	277	2.8
1993	19	319	4.0
1994	74	310	3.5
1995	44	136	1.2
1996	33	92	0.93
1997	26	78	0.84
1998	32	84	1.0
<b>Tuna Trips</b>			
1991	104	556	5.2
1992	55	458	5.3
1993	61	542	6.5
1994	83	568	7.0
1995	78	682	9.7
1996	76	657	10.4
1997	83	745	12.2
1998	92	760	13.5
<b>Mixed Trips<sup>2</sup></b>			
1991	94	823	4.7
1992	72	530	3.7
1993	59	331	2.6
1994	51	228	1.5
1995	49	307	2.4
1996	51	351	3.1
1997	44	302	2.5
1998	50	296	2.9

<sup>1</sup> In Millions of Hooks.

<sup>2</sup> Mixed trips refer to those that target a combination of swordfish and tuna species.

Source: NMFS, SWFSC Honolulu Laboratory.

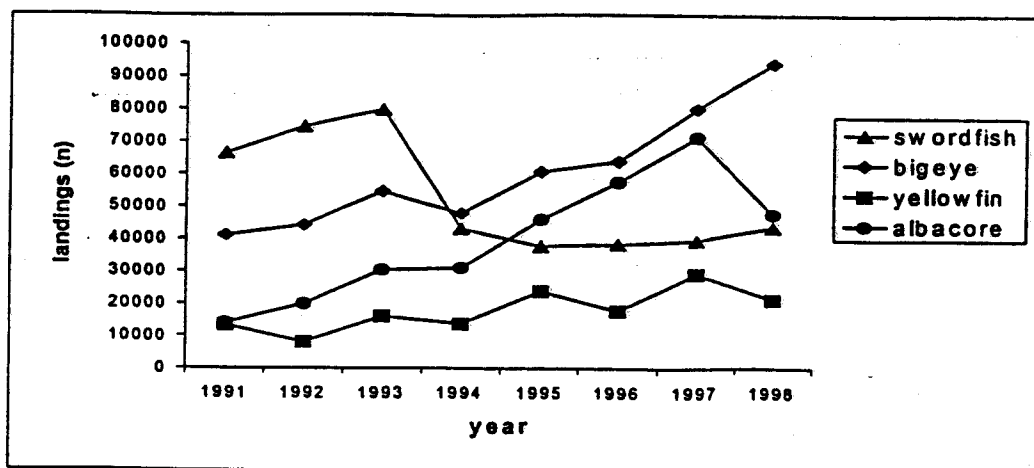


Figure 14.8. Distribution of this fishing effort with respect to target.

Table 14.6. Number of active vessels, total catch, and total fishing effort by the Hawaii-based longline fishery, 1991 to 1998.

Year	Number of Active Vessels	Number of Trips	Total Catch <sup>1</sup>	Total Effort <sup>2</sup>
Fleet				
1991	141	1670	19.6	12.3
1992	123	1265	21.1	11.7
1993	122	1192	25.3	13.0
1994	125	1106	18.4	12.0
1995	110	1125	29.7	13.3
1996	103	1100	21.5	14.4
1997	105	1125	27.1	15.6
1998	114	1140	28.6	17.4

<sup>1</sup> In Millions of Pounds.

<sup>2</sup> In Millions of Hooks.

Source: NMFS, SWFSC Honolulu Laboratory.



Longline fishing effort is not uniform throughout the year, with a seasonal decline in the number trips and hooks set in the third quarter. The percentage of hooks set in the third quarter represents 17.5 % of the annual total number set, while the numbers set in the first, second and fourth quarters are about equal and each represent about 27.5% of the total set each year. The distribution of fishing effort is not homogenous, with effort distributed between the US EEZ around the Hawaiian Islands, the other US EEZ waters in the Pacific and the high seas. On average, 57% of longline fishing occurs within the US EEZ surrounding the Hawaiian Islands, with a further 40% on the high seas and 3% in the US EEZs of islands such as Palmyra and Kingman Reef, Jarvis and Howland and Baker. The distribution of fishing effort in 1998 was notable for the high volume of fishing within the US EEZs of these mainly uninhabited islands (11.4%), particularly around Palmyra and Kingman Reef. This was in response to the high abundance of bigeye in these waters which occurs periodically in the lower latitudes to the south of Hawaii.

#### 14.5.3 Catches

The average catch composition of the Hawaii longline fishery, from NMFS logbook data between 1991 and 1998, is shown in Figure 14.9. Logbook catches are reported in numbers, and may be subsequently raised to weights using species averages. The two most economically important components of the catch, swordfish and bigeye, make about equal contributions to the catch in numbers, although the largest single component of the catch is sharks, most of which are blue shark (*Prionace glauca*). Other important components of the Hawaii long line catch include mahi mahi (*Coryphaena hippurus*) and albacore, both forming 11% of the catch, and yellowfin and striped marlin (*Tetrapturus audax*), both forming 5% of the catch. The remainder of the catch comprises other pelagic species such as ono (*Acanthocybium solandri*), blue marlin (*Makaira mazara*), other billfish and moonfish (*Lampris guttatus*).

There has been considerable inter-annual variation of the catch of the various components of the longline catch due to changes in the fishery with respect to targeting. Figure 13.8 shows the catches of swordfish and three principal tunas in the longline fishery from 1991 to 1998. Swordfish catches reached a peak in 1993 before declining sharply by about 50 per cent in 1994 and remaining at about this level between 1994 and 1998. By contrast, tuna landings have all show strongly increasing trends since 1991, with catch volumes more than doubling in the case of albacore and bigeye tunas.

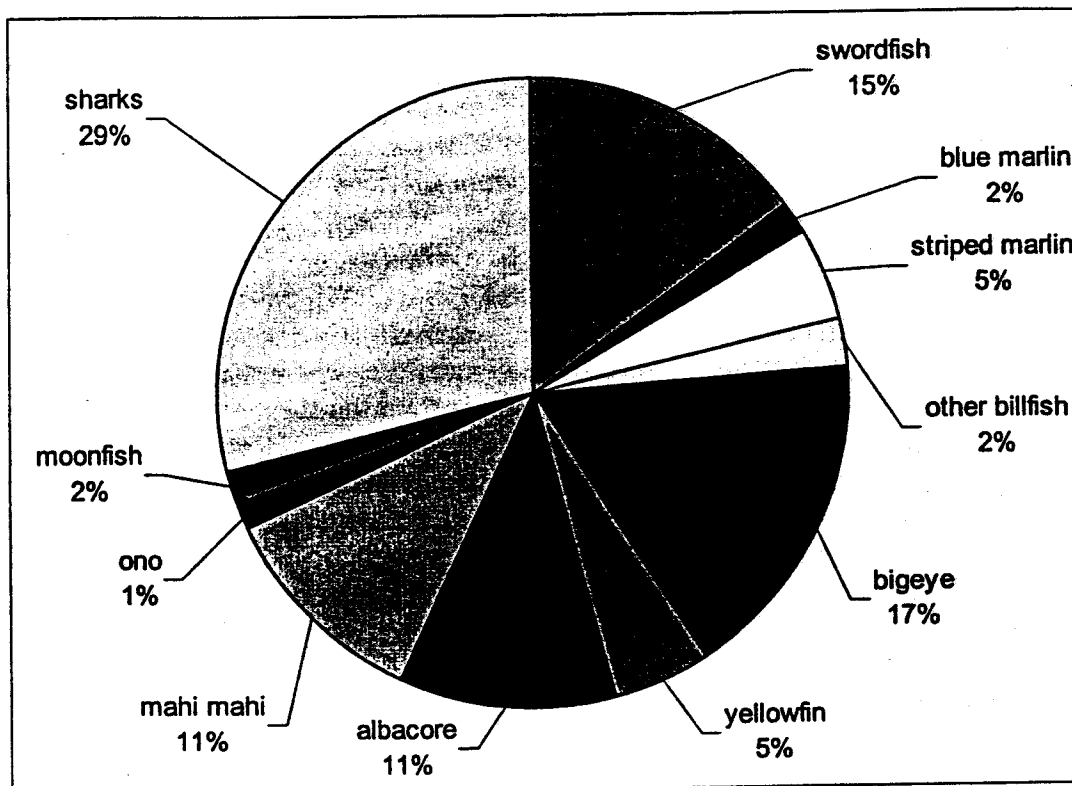


Figure 14.9. The average catch composition of the Hawaii longline fishery, from NMFS logbook data between 1991 and 1998.

## 15.0 Appendix V: Proposed Regulations

### PART 660 - FISHERIES OFF WEST COAST STATES AND IN THE WESTERN PACIFIC

1. The authority citation for part 660 continues to read as follows:

Authority: 16 U.S.C. 1801 et seq.

2. A new § 660.32 is added to Subpart C to read as follows:

#### § 660.32 Longline seabird mitigation measures.

The operator of a vessel registered for use under a Hawaii longline limited access permit and engaged in fishing for Pacific pelagic management unit species using longline gear above 25° North latitude must:

(a) Annually attend a NMFS workshop on longline protected species interaction mitigation methods and seabird handling techniques; and

(b) Release seabirds that are caught by longline gear in a manner that maximizes their long-term survival. The vessel operator must have readily available a long-handled scoop net, bolt cutters, pliers and a knife. If a seabird is hooked, the operator must stop the vessel to reduce the tension on the line and lift on board the seabird with the scoop net. Vessel crew must work in pairs to remove hooks from seabirds. Hooks must not be removed backwards. The line should be cut as close as possible to the hook, the hook barb pushed out point first through a small knife cut and cut off using bolt cutters, and then the hook shank removed. If an ingested hook is in the bird's stomach and cannot be removed, the line must be cut as close as possible to the hook. After removing entangled lines or hooks from seabirds, the birds must be left to recover for a short period before being released; and

(c) Use at least two of the following six seabird mitigation methods:

(1) Discharge offal strategically. While longline gear is being set or hauled, fish, fish parts or bait must be discharged on the opposite side of the vessel from where the longline is being set or hauled. Sufficient quantities of offal must be retained between sets for this purpose; or

(2) Night setting. Begin setting the longline gear at least one (1) hour after local sunset and complete the setting process at least one (1) before local sunrise, utilizing only a enough deck lighting to ensure safety; or

(3) Blue dyed bait. Thaw and dye blue all bait used. The color intensity of the blue-dyed bait must conform to a level specified by a color quality control card issued by NMFS; or

(4) Towed deterrent. Employ a NMFS approved tori line or towed buoy while setting and hauling the gear. The point of attachment between the tori line or towing line for the towed buoy, and the towing pole to which it is attached must be 4 to 8 m above the sea surface. The tori line or towing line for the towed buoy must be constructed of material that is between 5 mm and 8 mm in diameter. The tori line must be a minimum of 150 m in length and be weighted at the end so that it streams directly behind the vessel even in cross winds. If a towed buoy is used, it must be an inflatable type rubber buoy and be approximately 50 inches in circumference. The buoy must be attached to the towing pole by a line which is at least 175 ft long so that the buoy maintains a distance of approximately 150 ft behind the vessel during setting and hauling operations. For both types of deterrents, swivels must be placed every 20 m along the line to reduce twisting and a total of 7-10 pairs of streamers must be attached to the line at 5 m intervals

beginning 10 m from the point of attachment to the towing pole. The streamers must be made of a heavy, flexible material which allows them to move freely and be attached to the line using 3-way swivels or adjustable snaps. The tori line or towing line for the buoy must be attached to a towing pole at the stern of the vessel which is positioned such that it is directly above the baited hooks as they are deployed or hauled back. The streamers must be constructed and deployed in a manner such that they each skim the water's surface in the area where the gear is being set and hauled; or

(5) Weighted branch lines. Attach a weight of at least 45 g to each branch line within one (1) m of each hook; or

(6) Line-setting machine with weighted branch lines. Set the mainline using a line-setting machine similar to those currently utilized by some Hawaii longline vessels, (e.g. Lindgren-Pitman model LS-4), operating at least 1.3 times the average setting speed of the vessel. A weight of at least 45 g must be attached to each branch line within one (1) m of the hook;

3. In Section 660.22, new paragraphs (z), (aa), and (bb) are added to read as follows:

§ 660.22 Prohibitions.

\* \* \* \* \*

(z) Fish for Pacific pelagic management unit species using longline gear with a vessel registered for use under a Hawaii longline limited access permit above 25° North latitude without employing two or more of the seabird mitigation measures described in § 660.32(c).

(aa) Operate a vessel registered for use under a Hawaii longline limited access permit above 25° North latitude, using longline gear without annually attending a NMFS workshop on protected species interaction mitigation methods and seabird handling techniques.

(bb) Fail to release seabirds that are caught by longline gear in a manner that maximizes their long-term survival as described in § 660.32(b).

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